Engineering
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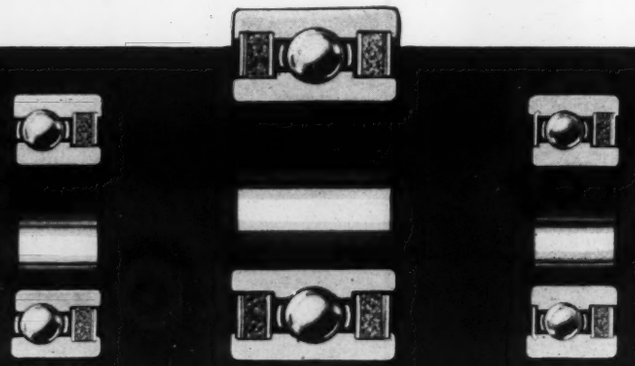
MACHINE DESIGN

AS IT AFFECTS

ENGINEERING—PRODUCTION—SALES



SELF-SEALED

Out of their experience of more than 23 years, NORMA-HOFFMANN engineers — pioneers in the design of enclosed and self-protected bearings —have developed and patented a range of types which meets practically every bearing condition and which affords the mechanical world

The Most Complete Line of SELF-PROTECTED BEARINGS in America

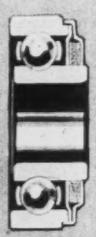
The "GREASEAL" Series of Felt-Protected Ball Bearings—in the three types illustrated above—is marked by the following outstanding features which make for better performance and more lasting satisfaction:- thick, closely-fitting felts between removable plates forming an effective labyrinth against the recessed inner ring - - - FELT SEAL REMOVABLE in its entirety for inspection, cleaning or renewal of grease - - - wide, solid inner and outer rings, with maximum contact on shaft and housing, make inserts in housing unnecessary and militate against slippage, looseness, and escape of lubricant past outer ring - - - felt seal within confines of both rings and not exposed to injury - - - constructional characteristics assuring dimensional exactness and quiet running - - - grease capacity ample for long periods of service. . . . . Eight other types of Self-Protected PRECISION Bearings are here pictured and indexed. Write for the complete Catalog. Let our engineers aid you in selection and application.

NORMA-HOFFMANN BEARINGS CORPN.

STAMFORD, CONN., U. S. A.

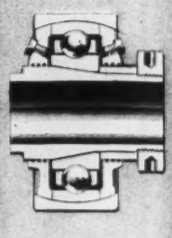
Type P—Closed type ball bearing with one grease - retaining plate.

Type PP—closed type ball bearing with two grease - reraining plates.

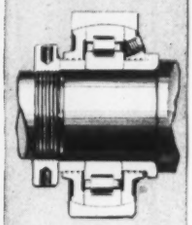


Type GS—"Greaseal" felt - protected, grease - packed ball bearing.

Type EGS—Adjustable, felt - protected, grease - packed ball bearing.

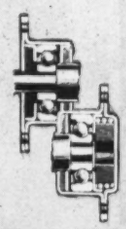


Type LTW—Self - aligning ball bearing with swiveling grease - retaining side plates and adapter sleeve.



Type RLSW—Self - aligning roller bearing with swiveling grease - retaining side plates.

Type RLTW—Self - aligning roller bearing with swiveling grease - retaining side plates and adapter sleeve.



CUP MOUNTING—Designed to use with small open type ball bearings in high-speed devices; furnished as complete units.

"NORMA-HOFFMANN"

PRECISION BEARINGS

BALL, ROLLER AND THRUST

MACHINE DESIGN

EDITOR
L. F. Jermy

ASSOCIATE EDITORS
Allen F. Clark
Harold B. Veith
F. H. Burgess

VOLUME VI NOVEMBER, 1934 NUMBER 11

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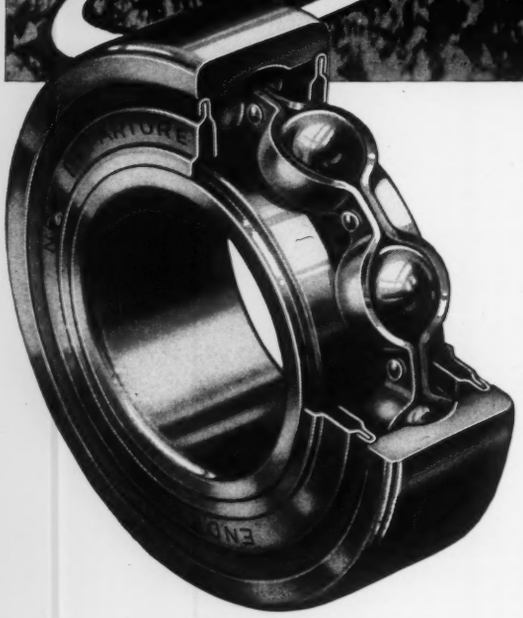
WIDE WORLD & AP PHOTOS



Double N-D-Seal Bearing
Lubricated for Life!

Successful bearing performance has always meant proper sealing against lubricant leakage and entrance of dirt —— but it has remained for New Departure to introduce a ball bearing with integral seals on both sides.

Now you may use ball bearings which are completely sealed and lubricated for life.

These bearings are designed for moderate speeds and should be used only on the recommendation of New Departure engineers. Full details upon request.

The New Departure Manufacturing Company, Bristol, Conn. Branches located at Detroit, Chicago, San Francisco.

NEW DEPARTURE
BALL BEARINGS

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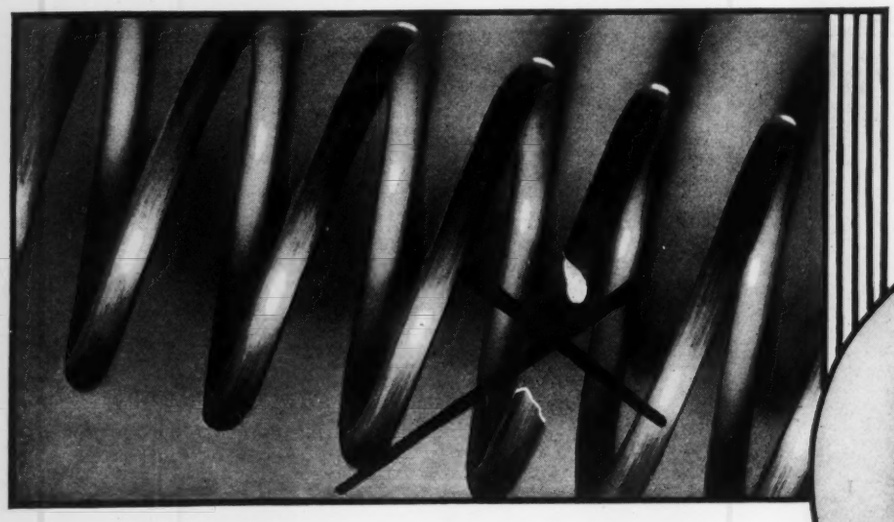
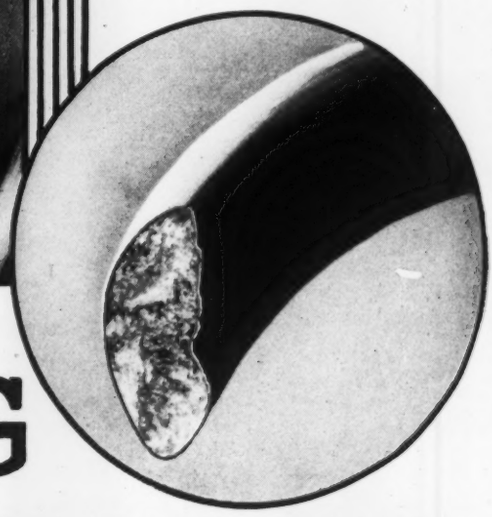


Photograph of spring coil which has failed in service due to over-stress. Proper allowance for unavoidable variation in commercial wire stock would have eliminated the error.



ELIMINATING SPRING FAILURES

THE fact that springs play an important part in almost all machinery operation—and that uninterrupted performance depends entirely upon their ability to function without mishap—calls for careful and specific study of two important factors; correct design and correct application.

CORRECT design pertains not only to size and shape of the spring—as applying to the variable portion of stress—but, also, to load deflection characteristics due to any one of several reasons. Correct application means perfect coordination between spring and machinery designers—the development of an improved type of spring to eliminate trouble and failure in an existing product—or the planning of a new machine so as to assure sufficient space and other factors vital to efficient spring usage. It is the proved ability of the American Steel & Wire Company to properly design springs—and to assist in their correct application—that has made this source of supply the recognized leader.

American QUALITY Steel & Wire Company **SPRINGS**

1831 — MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING — 1934

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
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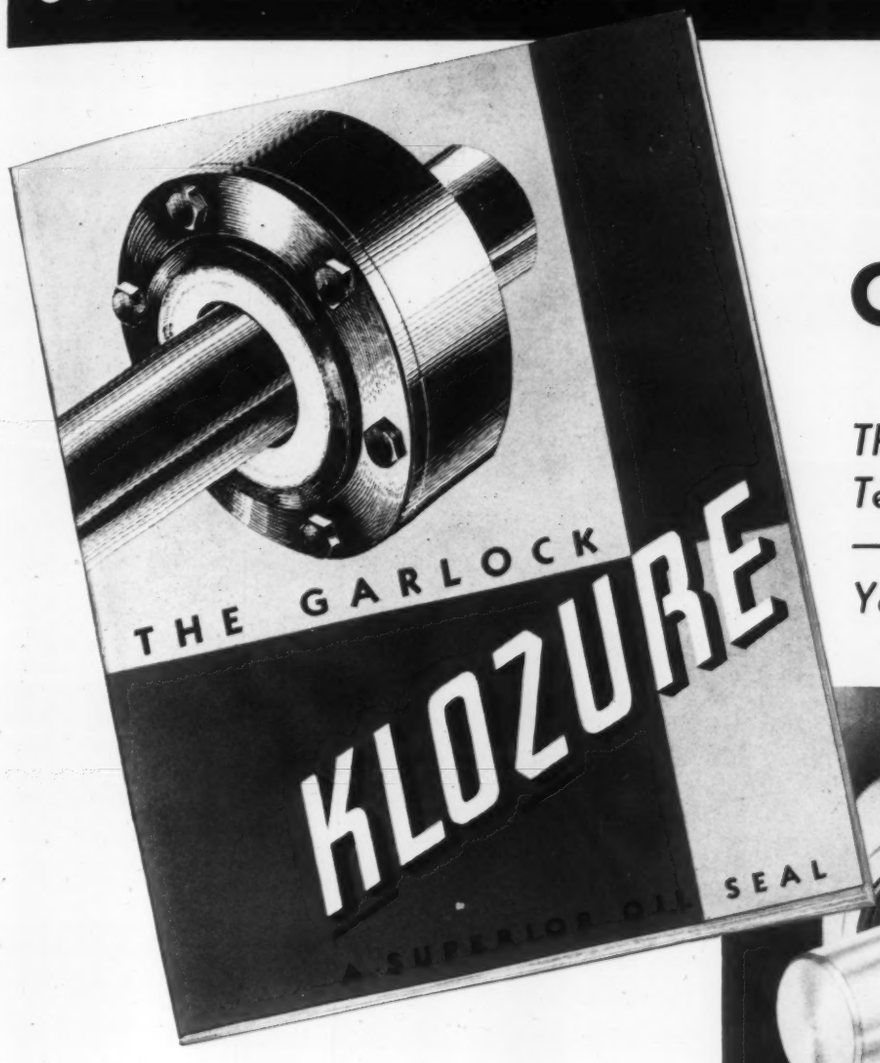
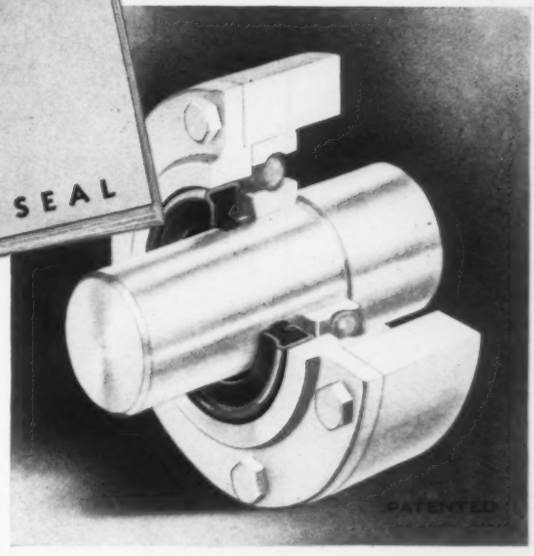
GARLOCK'S LATEST DEVELOPMENT



A NEW OIL SEAL

This Booklet Tells the Story —Write for Your Copy.



ORIGINAL in design — new in principle — simple in construction — dependable in operation — the Garlock Klozure has established remarkable performance records on many types of equipment.

Its mechanical precision, its resistance to oils at high or low temperatures and the semi-automatic action of its resilient sealing element are all features which combine to make the Garlock Klozure an outstanding device for any oil seal application.

A Garlock representative will gladly furnish you with literature and samples.

The illustration above shows the simple and effective design of the Garlock Klozure. Consisting of four parts only, this sturdy oil seal gives leak proof performance under the most severe conditions. Klozures are available in a wide range of sizes.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada, Limited, Montreal, Quebec

GARLOCK

IMPROVE YOUR PRODUCT

with this **LIGHT COMPACT G-E MOTOR**

ACTUAL SIZE
Typical G-E appliance motor—weighs only 33 ounces.

for your
office devices
kitchen appliances
advertising devices
sirens and
blowers

YOU can make your product lighter and more compact with this G-E appliance motor. Its oil-return bearings, rolled-steel frame, and die-cast end shields—features usually found only in large motors—will add vital sales advantage to your product.

Easily modified, both electrically and mechanically, this motor can be furnished with series, universal, or shaded-pole windings, and sleeve or ball bearings. It is readily adapted to a wide range of devices, for example:

KITCHEN APPLIANCES that must be sturdy, attractive, and compact.

OFFICE DEVICES that must be portable, compact, and trouble-free.

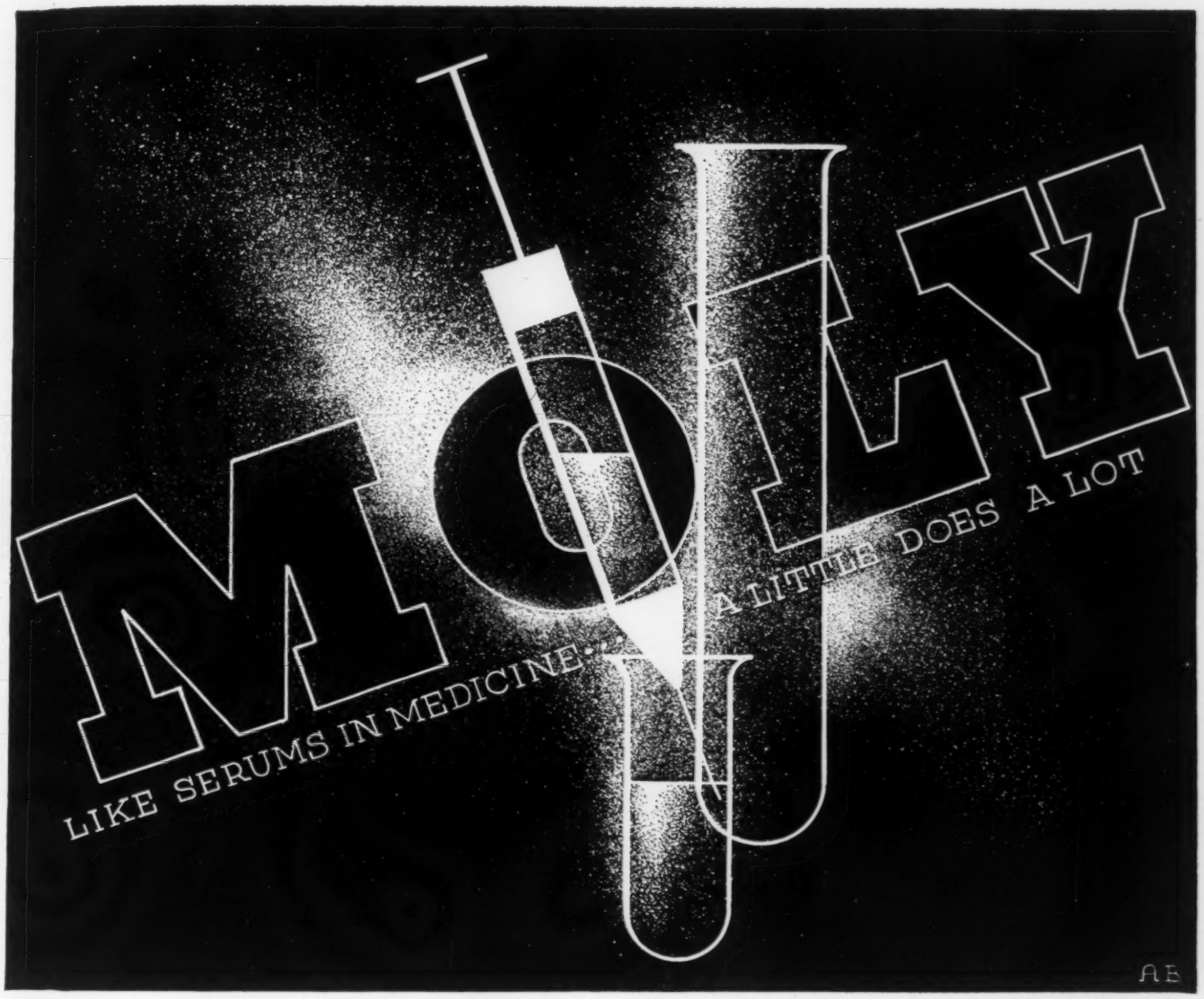
ADVERTISING DEVICES that require small, dependable motors.

SIRENS and BLOWERS that must have high speeds and compact designs.

Give your product the advantages of a G-E appliance motor. Write today for complete information. Address the nearest G-E sales office, or General Electric, Dept. 6B-201, Schenectady, N. Y.

070-50

GENERAL ELECTRIC



NOT only does a small addition of Molybdenum increase the strength and toughness of irons and steels, but it also builds up a stronger resistance to metal "diseases." . . . Corrosion, for instance:

For many years, a maker of large steam turbines had been using steel containing 12/15% Chromium for several of the turbine parts requiring superior corrosion-resistance. One difficulty encountered in this steel was its tendency at times to show a "wormy" finish on the forgings after pickling.

The addition of .50% Molybdenum has completely eliminated this trouble, saving the user far more than the additional cost of the "Moly" required. Furthermore, the Molybdenum serves to remove the tendency toward temper embrittlement that is occasionally encountered in this type of steel.

Molybdenum is a versatile alloy. It actually intensifies the desirable characteristics of other alloys. It contributes greater tensile and creep strength, wear-resistance; makes machining and welding easier. In fact, new analyses — combinations of "Moly" and other alloys — are constantly leading to further developments . . . which is one of the reasons for our having begun the publication of a house-organ, "*The Moly Matrix.*" It aims to help executives and engineers keep up to date with the progress of this extraordinary element. A request puts you on our mailing-list. An added request brings you either or both of these new books: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement*"; while the Climax metallurgists and experimental laboratories in Detroit offer willing assistance toward the solution of your alloy problems. Climax Molybdenum Company, 295 Madison Ave., New York.

CLIMAX Mo-lyb-den-um

CALENDAR OF MEETINGS AND EXPOSITIONS

Nov. 12-16—

American Bottlers of Carbonated Beverages.

Exposition of bottling machinery and equipment and annual meeting to be held at 106th Armory, Buffalo, N. Y. Offices of the organization are located at 726 Bond building, Washington.

Nov. 14-15—

National Founders association.

Annual meeting to be held at Waldorf-Astoria hotel, New York, J. M. Taylor, 9 South LaSalle street, Chicago, is secretary of the association.

Nov. 15-17—

American Institute of Chemical Engineers.

Annual meeting to be held at Hotel Schenley, Pittsburgh. Frederic J. LeMaistre, 808 Bellevue Court building, Philadelphia, is secretary of the institute.

Dec. 3-7—

American Society of Mechanical Engineers.

Technical papers to be presented at the annual meeting of the society to be held at Engineering Societies building, New York, will include: "A Mathematical Solution of the Rotor-Balancing Problem," by Jacob Bromberg; "Effects of Side Leakage in 120-Degree Centrally Supported Journal Bearings," by S. J. Needs; "Current Practice in Pressures, Speeds, Clearance and Lubrication of Oil-Film Bearings," by H. A. S. Howarth; "The Fatigue of Shafts at Fitted Members," by R. E. Peterson; "Stress Analysis of Failures in Machine Parts," by F. A. Mickle and F. L. Everett; and "Influence of Bends or Obstructions at the Fan Discharge Outlet on the Performance of Centrifugal Fans," by L. S. Marks, J. H. Raub and H. R. Pratt. Information on the meeting may be obtained from the society at 29 West Thirty-ninth street, New York.

Dec. 3-8—

National Exposition of Power and Mechanical Engineering.

Eleventh annual exhibition of transmission equipment, electrical machinery, steam plant equipment, prime movers and many other types of power machinery to be held at Grand Central Palace, New York. Information on the exhibition may be obtained from Charles F. Roth, Grand Central Palace, New York.

Dec. 5-7—

American Society of Refrigerating Engineers.

Annual meeting to be held at Hotel New Yorker, New York. David L. Fiske, 37 West Thirty-ninth street, New York, is secretary of the society.

Dec. 5-7—

Society of Industrial Engineers.

Annual meeting to be held at New York. Headquarters of the society are located at 29 West Thirty-ninth street, New York.

Jan. 5-12—

National Automobile Show.

Annual exhibitions to be held at Grand Central Palace, New York.

Jan. 10-12—

American Engineering council.

Annual meeting to be held at Washington hotel, Washington. F. M. Feiker, 744 Jackson place, Washington, is executive secretary of the council.

Jan. 14-18—

Society of Automotive Engineers.

Annual meeting to be held at Book-Cadillac hotel, Detroit. John A. C. Warner, 29 West Thirty-ninth street, New York, is secretary of the society.

Jan. 22-25—

American Institute of Electrical Engineers.

Annual winter meeting to be held at Engineering Societies building, New York. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary of the institute.

Feb. 17-22—

American Ceramic society.

Exposition and annual meeting to be held at Hotel Statler, Buffalo, N. Y. Ross C. Purdy, 2525 North High street, Columbus, O., is secretary of the society.

Feb. 18-21—

Technical Association of the Pulp and Paper Industry.

Exposition and annual meeting at the Waldorf-Astoria hotel, New York. R. G. Macdonald, 1 East Forty-second street, New York, is secretary of the association.

Feb. 18-21—

National Association of Coin Operated Machine Manufacturers.

Fifth annual coin machine exposition and annual meeting to be held at Hotel Sherman, Chicago, C. S. Darling, 120 South LaSalle street, Chicago, is secretary of the association.

What's New

IN VARIABLE SPEED APPLICATIONS

A heavy duty Attrition Mill for chip grinding service in paper mills and paper products plants is now standardly equipped with infinite variable speed control. Speeds of the crusher type feeder can be varied instantly as required by variations in size and kind of product. This complete flexibility is provided by the REEVES Variable Speed Transmission—individual motor unit.

★ ★ ★

A new textile machine called a One-Process Picker is equipped with variable speed control. This machine breaks open bales of cotton and forms the cotton into sheets or laps. Uniform thickness of sheets is important. This uniformity is accomplished through the REEVES Transmission with mechanical automatic control, which regulates speed of drums or calender rolls over which the sheets travel. A thin or thick place in the sheet of cotton automatically causes an increase or decrease in speed of the REEVES and hence in speed of calender rolls, thus compensating for inaccuracy in the lap.

★ ★ ★

Variable speed control is standard equipment on a Paper Excelsior Shredder which has been developed to reduce waste newsprint and magazine stock for packing purposes. A REEVES Transmission controls speed of a conveyor belt on this Shredder. The belt feeds paper to knives. Disc, carrying the knives, runs at constant speed. By varying speed of feed belt, various widths of excelsior are obtained, ranging from 1/8 to 1/2 inch.

★ ★ ★

1100 Machine Builders Use Reeves Speed Control As Standard Equipment

How can infinite variable speed control improve performance of machines you build? What design, speed ratio and control are best for your requirements? How should unit be applied? REEVES engineers have answered these questions for 1100 different machine builders. We have solved many speed control problems exactly like or similar to yours. A wide range of *time-tested* sizes, types, speed ratios, controls—including an internal operating mechanism for incorporation into a machine.

A combination of double spindles with a variable speed drive is a feature of a new Milling Machine. This combination gives great flexibility, center distance between spindles being adjustable over a wide range, while the REEVES Vari-Speed Motor Pulley adapts the machine to an amazing variety of operations. This compact REEVES unit forms a direct drive from the motor to the jackshaft.

★ ★ ★

A new Roll Feed Straightening Machine for use with punch presses incorporates infinite speed adjustability. This Straightener adapts punch presses to the blanking of parts from *coiled* rather than strip stock, thereby effecting many economies. Stock is fed from a reel through set of feed rolls regulated by a REEVES Transmission. Any required amount of metal may be fed between successive strokes of press. Feed rolls are regulated to compensate for thickness and width of metal, type of material, size and shape of blank desired.

★ ★ ★

Pictured below is the REEVES *horizontal enclosed Transmission with compact motor mounting—one of many modern units from the complete* REEVES *line of speed control equipment.*

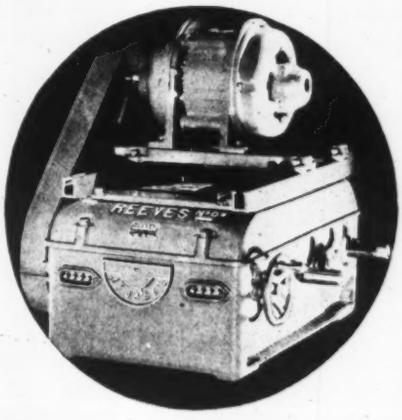


Illustration above shows the REEVES *vertical enclosed Transmission. Compact—conserves horizontal space on floor or in machine. "Centralized" lubrication. Protected against dust, water, chemicals.*

Power delivery is positive at all speeds, due to the time-tested REEVES *V-belt. Speed settings are held without fluctuation under varying loads, due to* REEVES *Automatic Belt Tension Control.*

See Our Exhibit at the Power Show, New York, December 3-8

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Send information on applying variable speed control for standard equipment, as contained in Catalog H-99, which describes the methods used by 1100 different machine builders. (11-34)

Name.....

Company.....

Address.....

PRECISION

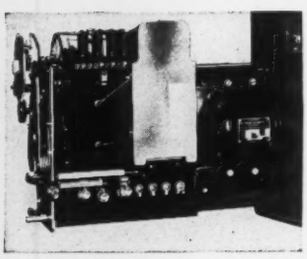
Precision, Exactness, Accuracy, even to one-quarter of one ten-thousandth of one inch! This is the unalterable standard responsible for the quiet, continuous, trouble-free operation of Emerson Motors.

Not *one* part is permitted to pass until skilled workers have gauged it true to the rigid requirements established by Emerson Engineers.

Not *one* Emerson Motor leaves for duty until it has been "on the testing line" long enough to prove its fitness.

Over forty years ago this policy of precision manufacturing was made "standard practice" in the Emerson factory. Adherence to this policy has definitely established Emerson as leaders in the fan and motor industry.

Emerson experience—modern, scientific laboratory equipment and individual engineering service will build for you *the* motor to meet your requirements. Write for booklet No. 1 — "Tests — Hundreds of Tests." It tells the complete story of how Emerson Precision Motors are built.



POTENTIOMETER PYROMETERS

Where Maximum Accuracy is Required

Precision instruments require precision built motors. And one of the outstanding manufacturers of such equipment has this to say about Emerson Motors:

"We have been using Emerson Motors in regular production some five years and their performance has been most satisfactory. Other important factors which have been very helpful in satisfactorily meeting our requirements are, the cooperation of the Emerson Engineering Division, adherence to delivery schedules and the general desire to work with us at all times."

Hundreds of manufacturers rely on Emerson Motors for a variety of exacting requirements, yet Emerson Motors are competitively priced.

EMERSON MOTORS

3 HP and smaller — Single-phase — Polyphase — Direct Current

THE EMERSON ELECTRIC MFG. CO.

NEW YORK ST. LOUIS CHICAGO

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

MACHINE DESIGN

THE JOHNSON PUBLISHING CO., CLEVELAND, OHIO

November, 1934 Vol. 6—No. 11

Sales Value of Appearance Can Be Protected

By George V. Woodling

HOW does it look? Is it beautiful? Is it attractive? Is it ornamental? These question are vital in design patents. And as the appearance of machines and parts is rapidly becoming of major importance, design patents are assuming a more prominent place in the thinking of the engineer. Engineering functions and details are, of course, the first consideration in the development of a new machine, but as the need for mechanical change lessens in intensity, thought should be given to the appearance angle, a most important factor in today's sales problem.

At the outset of this discussion, it is well to bear in mind the distinction between design patents and mechanical patents. In design patents the subject matter is addressed to the artistic appearance of the article, while in mechanical patents the subject matter is directed to its mechanical function. Design patents can not be obtained to protect the method or process by which the article is made. The method of creation is irrevelant.

Inasmuch as some designs are fleeting and soon lose their esthetic appeal, becoming commercially dead, patents for designs are granted for the terms of 3½, 7 or 14 years, as the applicant may elect. By reason of the fact that government fees, increasingly higher for each longer term, are not refunded, it is good practice to elect, in the application, a patent for the 3½ year term. This is because the designer cannot be certain, before he files application, whether or not the patent office will grant him the patent for his design. When the inventor learns that the design is patentable, he may then request a patent for

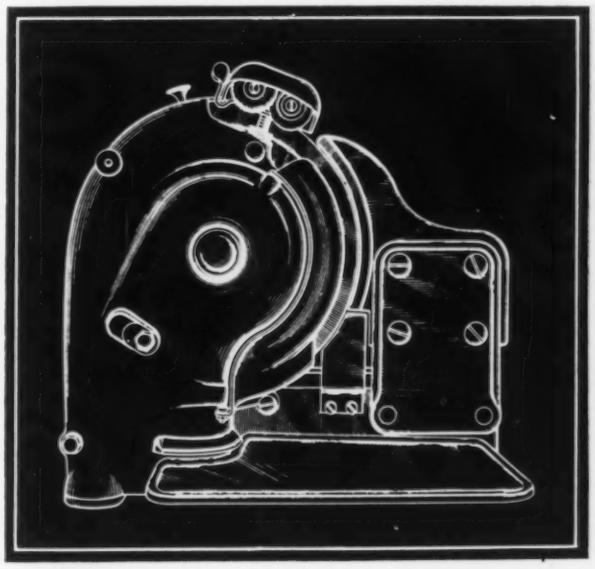


Fig. 1—Machines with moving parts, such as this slicing machine, have been protected by design patents covering appearance

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a longer term by paying the additional fee and amending the application.

It is difficult to establish a "yard stick" by which to gage whether or not a device warrants the protection of the design patent laws. This is because design patents are based upon the ornamental appearance of the article. What may be considered beautiful and ornamental by one person may be considered unattractive by another. Thus it was held that the "Kiddy-Car" shown in *Fig.* 4 did not possess sufficient ornamentation to substantiate a valid design patent. It may be of interest to note that the mechancal patent for the device was held to be valid. It must not, however, be construed that the design was fatal because it was exhibited upon a mechanical device devoted to functional purposes. The fatality resided in the fact that it lacked ornamentation as viewed by the patent laws. So long as an article possesses beauty and striking appeal it is not necessary that the design be made for the direct purpose of ornament, see *Fig.* 3.

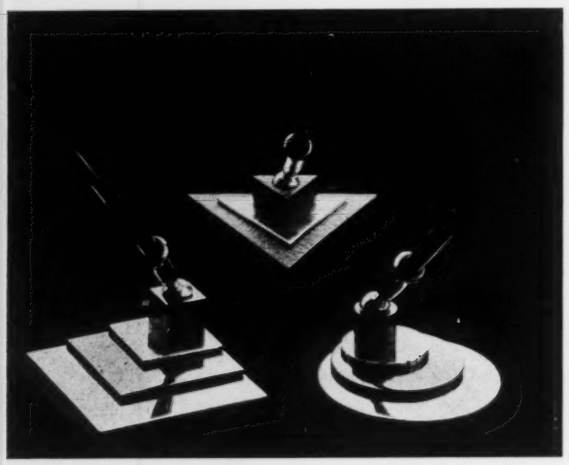

Fig. 2—Where two articles are used together the patent drawings must show them separately

Original Design Necessary

In addition to a device being ornamental and beautiful, it must be *new* and *original* to qualify for a design patent. In the patent laws the term "original" has special reference to the inventive genius displayed in creating the designs. The inventor must have created a design which an ordinary person skilled in the art would not create if called upon to do the task. Accordingly, the exercise of mere routine skill in the selection of colors and in the arrangement of parts does not amount to invention. The selection of material from which an article is made and its size is not considered to be invention. Nor is it invention, ordinarily, to find a new use for an old design, unless there is a new appearance or new harmony created in its new environment.

The term "new," as applied in the patent laws, has reference to whether or not the alleged inventor is really the first inventor. Although it happens infrequently, two inventors may make substantially the same design. If both of them should file a design application, the patent office declares what is termed an "interference" to determine who is entitled to the design patent. The procedure in design interferences is very much the same as that followed in mechanical patents, (M. D., Nov., 1933). It is a safe policy, in order to insure the greatest protection, to file the design patent application before the article is displayed to the public. This helps avoid the risk of competitors copying the idea.

The appearance of designs is gaged not by experts or skilled artists, but by the eye of an ordinary observer. The test is that he must give such attention to the article as a purchaser usually gives. If the resemblance of two designs is such that an ordinary observer would mistake one for the other, then the two designs are said to be substantially identical. It has been further held that designs must be considered as a whole, and not from the angle of the various parts which make up the design.

In some designs there may be a dominating feature which distinguishes the design from other similar items. This must be taken into consideration when comparing the design, as well as whether or not the dominating trait is of itself unique. But, as a general rule, designs are made up of plurality of features in which all of the characteristics blend together to give a single harmonious effect.

Must Cover Articles Separately

There are cases where two articles are used together, such as the combination of a fountain pen and the pen stand shown in *Fig.* 2. However, the pen and the pen stand when taken together is not a unitary design, but merely the aggregation of the two articles. The design patent drawings which were originally submitted to the patent office included the pen as well as the pen stand. The patent office held that the pen must be deleted from the drawings.

It appears to be fairly well settled that it is not necessary to have absolute immovability of the parts in order to warrant a design patent. There may be some relative movements of the parts of a design without changing the general appearance of the article. In such cases there appears to be no doubt that a valid patent may be granted. An interesting illustration of this point is the design of the meat slicing machine, *Fig.* 1, on which a patent was granted. But, on the contrary, it is fairly well established that where the movements of the various parts are sufficient to cause an ever changing appearance, the machine is not the proper subject for a design patent.

Despite rulings in their favor, some decisions have held that machines which have movable parts are not the subject of design patents be-

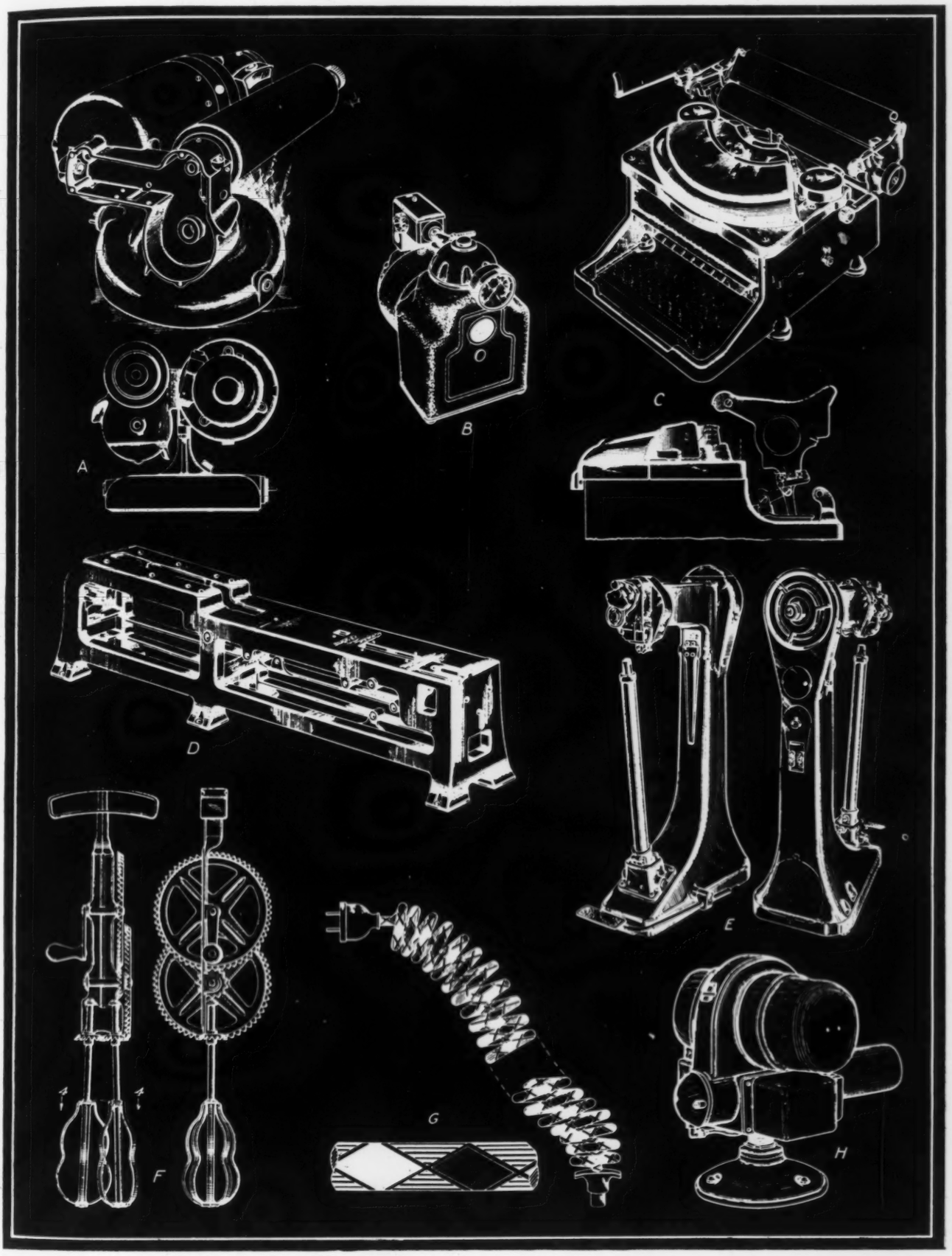

Fig. 3—Typical machines and parts covered by design patents in which the inventors claim the ornamental design for: A—a talking machine frame; B—an air compressor; C—a typewriter; D—a cigarette machine frame; E—a wire stitching machine; F—an egg beater; G—a coil cord for electric current; and H—an oil burner. Most of these designs, including the one for the egg beater, were patented within the last few months

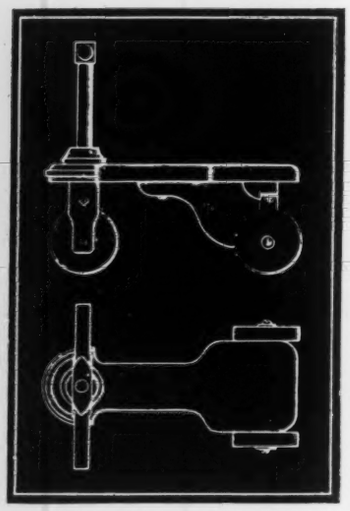

Fig. 4—It was ruled that this child's vehicle was not sufficiently attractive to warrant a valid design patent

cause the design patent laws specifically provide that these patents are grantable for things which are considered to be articles of manufacture. An article of manufacture may be considered to be a device having no rule of action, as contrasted with a machine which has moving parts. An inspection of the design patents illustrated in *Fig.* 3 bears out the fact that the patent office apparently does not strictly follow these decisions. In this connection, note particularly the egg beater at *F*.

Also there are some decisions which indicate that since a machine having movable parts cannot be protected by a design patent, the several parts themselves, provided they are unique, may be separately protected. The machine frame, *D*, *Fig.* 3, is a design which comes under this classification. There is some argument against the practice of granting design patents upon the parts of machine, for the reason that it is only the complete machine that meets the requirements of the patent statutes, and not the parts thereof. Argument is further advanced that the parts of a machine are not usually offered for sale by themselves; nor are they displayed, except in relation with the entire machine.

In securing patent protection upon a new device, it is sometimes difficult to determine the best kind of protection to seek. A single production may be capable of supporting either a mechanical patent or a design patent, or both. That is to say, the finished article may be beautiful, as well as possessing mechanical utility. Ordinarily, the grant of a design patent does not preclude the grant of a mechanical patent upon the same device, or vice versa. This is because, in the statutes, design patents and mechanical patents are covered by two distinct monopolies. To this general rule there appears to be an exception when the drawing for the design patent is substantially the same as that in the mechanical patent, in which case either one or both of the patents may be held invalid.

A good example of such a case is the horseshoe calk shown in *Fig.* 5. In this case, the inventor first obtained a design patent and subsequently a mechanical patent, showing substantially the same drawing. In a suit filed upon the design patent and the mechanical patent, it was held that the design patent was invalid because it was not beautiful or ornamental. It was further held that the mechanical patent was invalid in view of the prior design patent, notwithstanding the fact that the design patent was held to be invalid. The Court pointed out that:

> "It is regrettable that the inventor did not at the outstart, as he did later, take out a mechanical, instead of a design patent for his horseshoe calk; for it is in its useful features that the odd value of the invention resides, and not in its pleasing configuration to the eye, whatever that may contribute to it; and the contrary being the fact, I do not see how all things considered, either patent can be sustained."

The same question was raised with reference to the "Kiddy-Car," *Fig.* 4. In this case, however, the inventor applied for his mechanical patent before he applied for his design patent, but the design patent was issued before the mechanical patent. The Court held that while the design patent was invalid on the ground of lacking ornamentation, yet the mere fact that it was issued prior to the mechanical patent did not invalidate the mechanical patent. In view of the conflicting decisions on this question, it is good practice to file the mechanical patent prior to the filing of the design patent, and, if at all possible, the mechanical patent should not only be applied for first but should likewise be granted first. In this manner, if an objection is raised only the design patent will be declared invalid. This will leave the good mechanical patent which gives much broader protection.

Drawings Should Differ

In cases where it is desirable from the commercial point of view to file immediate design patent applications, as well as mechanical patent applications, the only safe rule to follow is to make the drawings in the mechanical application differ from those shown in the design patent application. This can be done easily by distorting the mechanical features. In a mechanical patent the protection sought is the mechanical utility, so the fact that the feaures are somewhat distorted to obviate the design patent

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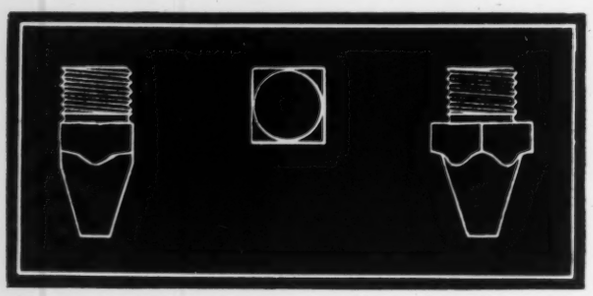


Fig. 5—A design patent on this device, issued before the mechanical patent, invalidated the latter

SCANNING THE FIELD FOR IDEAS

CHANGE CREATES SALES APPEAL

MINDFUL of the potentialities of the market for domestic equipment, enterprising designers have not been lax in their anticipation of unique features and ideas that will attract buyers. In clock design for example, Seth Thomas has retained Henry Dreyfuss to produce the two models shown in Fig. 1. One of the striking trends observed is the absence of figures on the dial. The raised disks for hour marking on the one unit and gun metal disks instead of the conventional numbers on the other express a new note that probably is a harbinger of a design change. The hands and cabinets add distinction to these units.

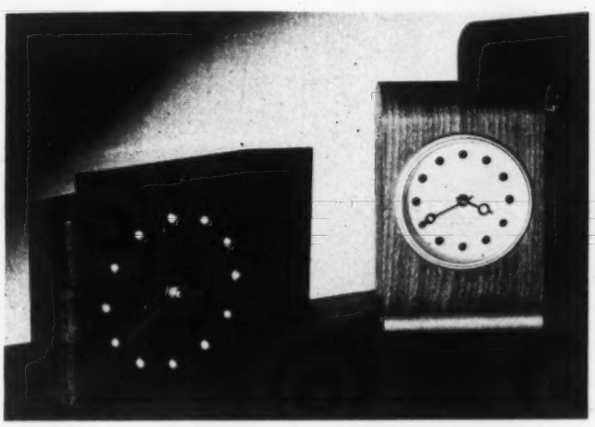


Fig. 1—These changes in clock design indicate what can be done to stimulate consumers' desire to buy

Another vogue in time recording is indicated by a new Pennwood electric clock. The conventional hour and seconds hands are discarded in favor of four numerical drums which show the time in railroad fashion—4:36, 4:37 and so on. The drums are mounted on a bakelite molded block which provides strength and insulation value. Cases also are bakelite.

Attention not only is being given to the replacement market but entirely new fields are being opened by such equipment as a humidor which recently was introduced by C. B. Howard Co. Inc. It is a coin-operated cigarette vending machine designed for installation in the home. The package dispensing mechanism is concealed from view. Outwardly the unit represents a fine piece of furniture. Six models are available, ranging in design from the classic to the modern. In addition to serving as a self-merchandiser, the humidors can be used as end tables, etc. The market that exists in the American home holds literally thousands of such opportunities for engineers who will but seize them.

VENTURI TUBE ACTS AS PUMP

USE of a venturi in an air line to obtain a high velocity which draws out oil vapors as fast as they are formed prevents carbon deposits in a newly developed gasifier. This occurs in the process of burning fuel oil as gas. Because it requires heat to change liquid oil into a gas, carbon deposits form and this has in the past hindered the successful operation of equipment designed to gasify the oil. In this new development of Chicago Flexible Shaft, vapors mixed with air in proper proportions are fed to the furnace at high temperatures. The resulting oilgas is handled in the burners the same as natural or manufactured gas.

ATTAINING CONSTANT PRESSURE

TWO relatively semicircular impellers rotating in intersecting paths are utilized to obtain an interesting pumping principle. The action that takes place in this type of unit is shown in *Fig.* 2. Wear is reduced to a minimum because no scraping fits are necessary to maintain pressure which ranges up to 1500 pounds per square inch. The Bump principle, as it is known,

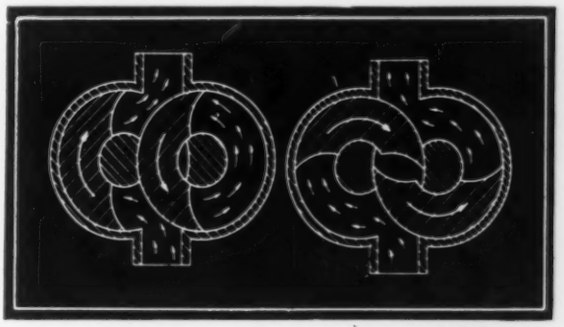


Fig. 2—Method of drawing in liquid and discharging it is unusual in this rotary pump

somewhat resembles the action of a reciprocating piston pump in that each are of the positive displacement type. However, rotation of the pistons or impellers of the former obviates pulsations.

Impellers drive in a circular direction at constant velocity, creating an even pressure on liquids in the line. Churning in the pump is eliminated because the liquid is taken in and pushed out (see arrows) through large unobstructed passages. Waukesha metal, a high nickel alloy, is used for all parts coming into contact with liquid. This type of pump will handle heavy products such as ice cream, tomato pulp, mayonnaise, cheese, etc.

USING THE BOILER PRINCIPLE

CURIOUSLY enough, the boiler furnished an idea for a new type of fresh air heater. This Ford V-8 heating unit, as shown in *Fig.* 3, is built with 24 flues each 13 inches long. Almost 500 square inches of heat radiating surface is provided. The flues are an integral part of the engine exhaust line. Fresh air forced into the jacket which surrounds the tubes is circulated about, heated almost instantly and blown back into the car. This is an entirely new principle in motor car heater design.

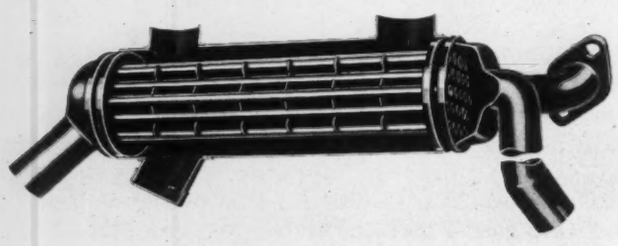


Fig. 3—Patterned after boiler construction, this new automobile heater supplies warm fresh air by passing it over flues

PROGRESSIVE STEPS IN WELDING

AMONG available production facilities that may aid designers in carrying new ideas to satisfactory completion is the General Electric stud welder. A stud is placed in the welding gun, *Fig.* 4, pressed against the surface to which it is to be fused ,and one automatically timed impulse of power completes the weld.

From a design standpoint also the gun is interesting. It provides a tool for holding the stud against the work under spring pressure. Most parts are made of aluminum, an important factor in reducing the weight of the device which will accommodate studs from ⅛ to 5/16 inch in diameter and from ½ to 2½ inches long. A control switch in the spade type handle of the gun controls the action of the automatic timer located on the control panel of the welding machine.

Arc welding effected a savings of thirty-five per cent in weight in the construction of fifty-two new streamlined steel passenger coaches which the Chicago, Milwaukee, St. Paul and Pacific railroad is building. A built-up design consisting of structural shapes, plates and sheets joined by welding is the basis for construction of the underframe which includes the center sill, bolsters, buffer beams and body end sills.

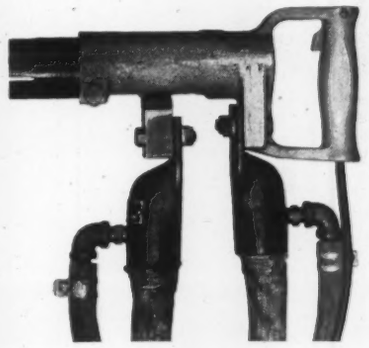


Fig. 4 — Welding equipment such as this stud welding gun furnishes wider production facilities for carrying out designers' ideas

Construction of the turtle-back roof consists of steel sheets of only 1/16-inch thickness pressed into pans flanged on all four sides, and also 3/16-inch pressed side plates. Steel strip ⅛-inch by 3 inches welded between the center pan flanges form the ridge pole. In welding the roof pans, strips project above the surface of the pans and the carbon arc employed in the automatic welding melts the strip down, thus providing filler metal between the flanges. The typical weld employed in construction of the roof is shown in *Fig.* 5. Welding equipment for this development was supplied by Lincoln Electric Co.

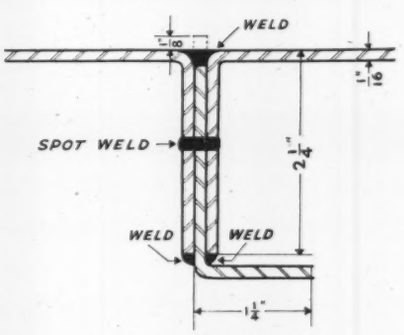


Fig. 5—Railroad car roof design shows what can be accomplished in welding steel sheets of only 1/16-inch thickness

DIFFERENTIAL IMPROVES DRIVE

DIFFERENTIAL gearing operating in connection with two motors is being employed for obtaining welding wire feed control in Una arc welding heads. This system allows instantaneous reversal of direction of the wire. The

down drive motor, at the left, *Fig.* 6, is a constant speed unit. It has ample power to pull the electrode from the reel and drive it through the feed nozzle without slowing down or affecting the rate of welding wire travel.

Variable speed operation for the welding head is obtained by a direct current up drive motor, the shunt field of which is connected across the terminals of the generator of the auxiliary motor generator set thus giving full torque to the motor under all conditions. Variations in speed are obtained by connecting the armature across the same generator but in series with the arc, so that the arc voltage "bucks down" that of the generator.

By wiring the unit in this way the speed of the up drive motor bears a direct ratio to the rate of welding wire travel and to the arc voltage. This gives quick acceleration when the rate of welding wire travel is being reduced and equally rapid deceleration, due to dynamic braking, when the rate of welding wire feed is increased.

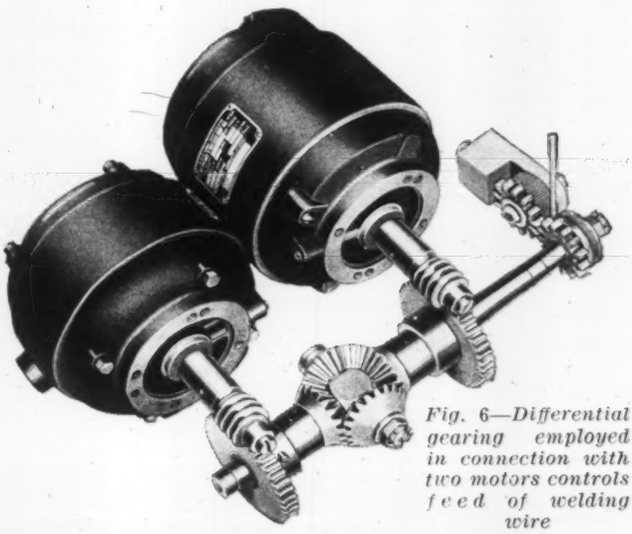


Fig. 6—*Differential gearing employed in connection with two motors controls feed of welding wire*

Ratio of the gearing in the differential is such that a difference of approximately 300 revolutions per minute in the speed of the two motors gives a welding wire feed equal to the melting rate of the average electrode. In other words when the direct current up drive motor operates at 1450 revolutions per minute the welding wire will be fed at its normal rate. When this motor increases its speed to 1750 the wire is stationary and at 2050 revolutions per minute the wire will be withdrawn from the work at a speed equal to full melting rate.

SEALING METAL TO GLASS

MANY possibilities in the development of various devices wherein lead-in wires or conducting parts must pass through gas-tight insulating seals or themselves form part of a gas-tight chamber have been opened up to engineers by a new metal-to-glass seal. This innovation, produced in the research laboratories of General Electric Co., facilitates tight and reliable joints between glass and an alloy known as Fernico.

Fernico can be machined, forged, punched, drawn, stamped soldered, copper brazed and welded with a facility equal to that with which these operations can be performed on a high grade nickel iron. The physical characteristic of the alloy which makes possible its successful fusion to glass, *Fig.* 7, is its expansion curve. This coincides with that of certain glasses.

Fig. 7—*No more care is required in cooling this combination of metal and glass after they have been sealed together, than is necessary in dealing with glass alone*

LIP ON TUBE CONTROLS DRIPPAGE

MILK flowing over tubes of an external cooling system drops from one tube to another in its downward course. In order that the liquid will fall properly on to each subsequent tube a lip, *Fig.* 8 has been employed. The drip-lip tube of Enduro is built up of two separate sections, one being telescoped into the other. The outer tube having the lip is formed from flat strip and has the lip rolled in before it is roll-formed into a butted tube and welded. The polished tubes are set into racks, one above the other, and refrigerant is circulated through them. Steel & Tubes Inc. is the manufacturer.

Fig. 8—*A lip that is integral with a formed tube directs flow of milk in cooling system*

Tabulated Drawings Simplify Drafting Procedure

By J. S. Wojcik
Mansfield Works, Westinghouse Electric & Mfg. Co.

WORKING drawings are the language of the shop—a method of showing graphically the exact details of parts and assembly of devices and apparatus. With them, one craftsman speaks to another.

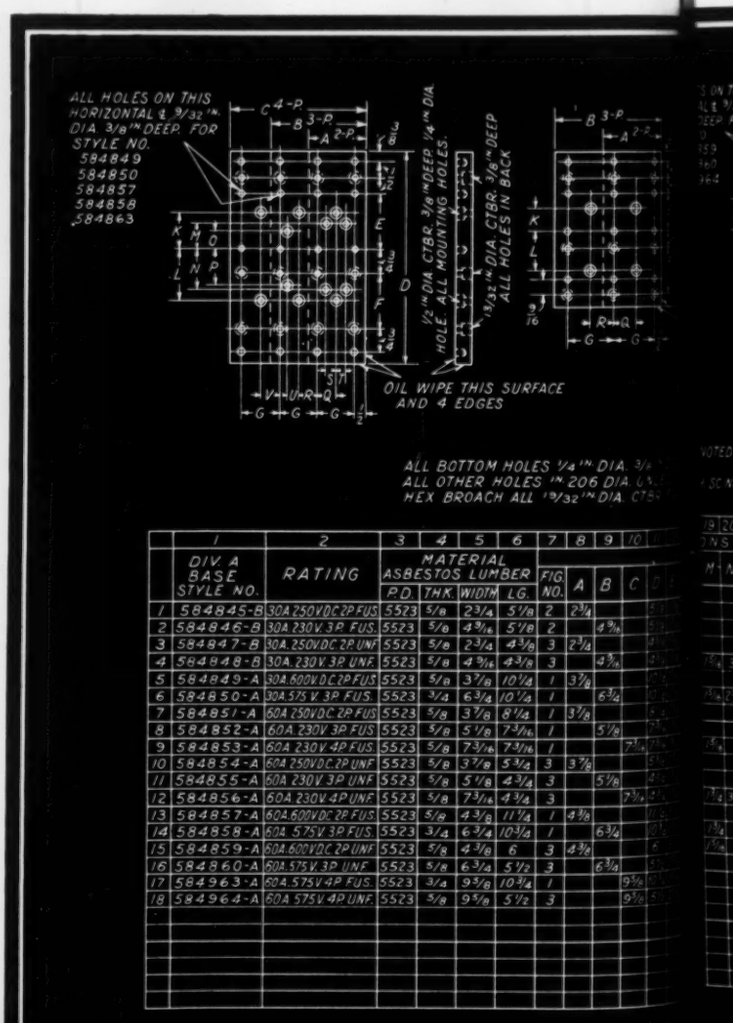
But working drawings may be, figuratively speaking, long-hand or short-hand drawings. Some engineering departments delight in making their drawings elaborate, believing that the more drawings that are made for a new design, the greater a success they have accomplished from the standpoint of numbers of drawings turned out. Each part is usually shown on a separate drawing, or only a few parts are allowed to a drawing. Assembly and subassembly drawings are numerous; the total number of drawings required to furnish complete information for the construction of the device or apparatus is certainly large. We may call this "long-hand" information.

Fewer Drawings Employed

On the other hand, the efficient drawing room will try to make the number of drawings required for the design of new devices or apparatus as small as possible, using "short-hand" we might say. As many similar parts as possible are shown on one drawing. If necessary, the dimensions for the parts are tabulated. The following description will serve as an example of how, with a little thought, drafting room production can be stepped up, and the number of drawings required for complete information can be greatly reduced.

Recently it was decided to introduce a completely new line of switches. The total number of different sizes of complete switches was 57. Total number of enclosing cabinets required was 43, and as the cabinet is composed of three component parts, namely, the side-band, bottom and cover, this makes a total of 129 more parts. The device also required 43 base assemblies mounted in the cabinet, and each base assembly in turn required a different size of base, making 43 more parts. The sum total of drawings required, if all of the parts were to be placed on separate drawings, is certainly staggering!

It was decided, in connection with this design, to make a few tabulated drawings which would give all of the necessary information in a competent manner. An example of these tabulated drawings is shown in the accompanying illustration. The left hand view in this drawing shows the base details for the new device for bases of the small type, while the right hand view gives data for bases of the larger type. If the unit system of working drawings had been used for issuing information for the fabrication of these bases, forty-three drawings would have


ALL HOLES ON THIS HORIZONTAL & 9/32" DIA. 3/8" DEEP. FOR STYLE NO.
584849
584850
584857
584858
584863
1/2" DIA CTBR. 3/8" DEEP. 1/4" DIA HOLE. ALL MOUNTING HOLES.
13/32" DIA. CTBR. 3/16" DEEP ALL HOLES IN BACK
OIL WIPE THIS SURFACE AND 4 EDGES
ALL BOTTOM HOLES 1/4" DIA.
ALL OTHER HOLES 13/206 DIA.
HEX BROACH ALL 19/32" DIA. CTB

	1	2	3	4	5	6	7	8	9	10
	DIV. A BASE STYLE NO.	RATING	MATERIAL ASBESTOS LUMBER P.D.	THK.	WIDTH	LG.	FIG NO.	A	B	C
1	584845-B	30A 250VDC 2P FUS.	5523	5/8	2 3/4	5 1/8	2	2 3/4		
2	584846-B	30A 230V 3P FUS.	5523	5/8	4 3/4	5 1/8	2		4 3/4	
3	584847-B	30A 250VDC 2P UNF	5523	5/8	2 3/4	4 3/8	3	2 3/4		
4	584848-B	30A 230V 3P UNF.	5523	5/8	4 9/16	4 3/8	3		4 3/4	
5	584849-A	30A 600V DC 2P FUS	5523	5/8	3 7/8	10 1/4	1	3 7/8		
6	584850-A	30A 575 V 3P FUS.	5523	3/4	6 3/4	10 1/4	1		6 3/4	
7	584851-A	60A 250VDC 2P FUS	5523	5/8	3 7/8	8 1/4	1	3 7/8		
8	584852-A	60A 230V 3P FUS.	5523	5/8	5 1/8	7 3/16	1		5 1/8	
9	584853-A	60A 230V 4P FUS.	5523	5/8	7 3/16	7 3/16	1			7 3/16
10	584854-A	60A 250VDC 2P UNF	5523	5/8	3 7/8	5 3/4	3	3 7/8		
11	584855-A	60A 230V 3P UNF	5523	5/8	5 1/16	4 3/4	3		5 1/16	
12	584856-A	60A 230V 4P UNF	5523	5/8	7 3/16	4 3/4	3			7 3/16
13	584857-A	60A 600VDC 2P FUS.	5523	5/8	4 3/8	11 1/4	1	4 3/8		
14	584858-A	60A. 575V 3P FUS.	5523	3/4	6 3/4	10 3/4	1		6 3/4	
15	584859-A	60A 600VDC 2P UNF	5523	5/8	4 3/8	6	3	4 3/8		
16	584860-A	60A 575V 3P UNF.	5523	5/8	6 3/4	5 1/2	3		6 3/4	
17	584963-A	60A 575V 4P FUS.	5523	3/4	9 5/8	10 3/4	1			9 5/8
18	584964-A	60A 575V 4P UNF.	5523	5/8	9 5/8	5 1/2	3			9 5/8

been required. Consider the handling, printing and filing of the number of drawings normally required for not only these base details but for the entire job, and also the inconvenience in the shop when making tools and fixtures for parts from so many drawings.

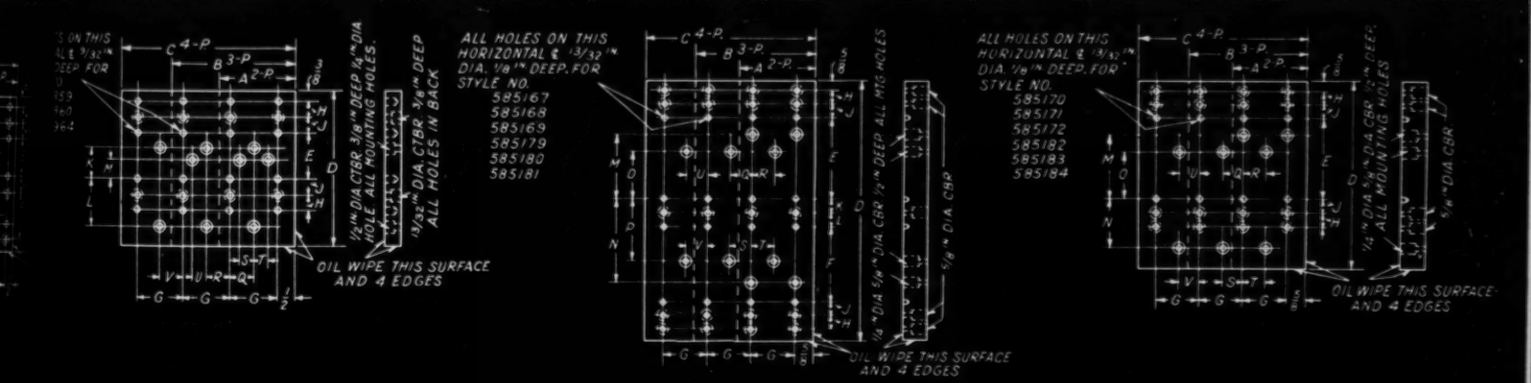
Other drawings in the series include a drawing, division A of which shows the assembly of three component parts of the cabinet, the sideband, the bottom and cover. It also shows the cover hinge, cover catch, stop bracket and the base mounting spacers. Definitely outlined are the steps in the production of the cabinet. It might seem that the views of the assembled cabinet would appear complicated to the worker, but even though the appearance of the drawing did seem complicated, no trouble is experienced as the welding fixtures used in assembling the parts are properly identified. The drawing is actually used only as a reference for final inspection approval. With it, the user has before him all of the cabinets on one drawing instead of dozens of drawings. The method of presenting the subject allows cabinets of similar design to be added to this same drawing.

Division B of this drawing is a tabulated drawing for the cover of the cabinet. Two plan views were required for this cover due to the type of hinge employed on the two types of cabinets: One uses the ear type hinge while the other is designed for a butt hinge. Due to the fact that a template is made for each size of cover, the drawing has to be gone over dimension by dimension only once—when the templates are being made—then the drawing is used for setting up tools and inspection.

Drawing Is Used for Reference

Another drawing is devoted to the side band and bottom for the enclosing cabinet. Since templates are made for the side bands and bottom, this drawing also is used mostly for reference and inspection checking. A most important drawing in the series is the key or master drawing for base assembly which shows the assembly of the current-carrying copper parts and operating members. Only four views are necessary to convey clearly to the workman the exact relation of the component parts. Tabulated columns and lines below the views serve as the bill of material for the required size of base assembly. Originally this drawing was for the 43 base assemblies mentioned in the beginning of this article. Since then, eight more types have been added. All that was required was a few minutes to fill in the proper spaces with the necessary information and the working drawing information is completed.

The extra thought required to lay out this compact method of tabulating the dimensions and views is fully justified, as the addition of new parts and assemblies of similar design becomes more of a clerical than a drafting function.



ALL BOTTOMED HOLES 11/32" DIA. 1/8" DEEP UNLESS OTHERWISE NOTED
ALL OTHER HOLES 11/32" DIA. UNLESS OTHERWISE NOTED.
ALL 5/8" DIA. C'BR. HOLES IN BACK OF BASE 1/2" DEEP HEX. BROACH FOR 5/16"-18 HEX. I. NUT.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
DIV B BASE STYLE NO.	RATING	MATERIAL ASBESTOS LUMBER				FIG NO	DIMENSIONS																				
		PD	THK	WIDTH	LG		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V
585161-A	100A 250 V 2P FUS	5523	3/4	4 1/2	14 3/16	1	4 1/2			2 3/16	3 1/16	3 1/16	3 1/16	3/4	7/8	7/8	7/8	1 5/16	4 3/16								
585162-A	100A 230 V 3P FUS	5523	3/4	5 1/2	13	1		5 1/2		13	1 7/16	4 7/16	2 1/16	3/4	7/8	7/8	7/8		15/16	5		1 1/16	1 1/16	2 1/16	2 1/16		
585163-A	100A 230 V 4P FUS	5523	3/4	7 5/16	13	1			2 5/16	13	1 7/16	4 7/16	2 1/16	3/4	7/8	7/8	7/8		15/16	5		1 1/16		1 1/16	1 1/16	1 1/16	
585164-A	100A 250 V 2P UNF	5523	3/4	4 1/2	7 1/16	2	4 1/2			7 1/16	3 3/16		3 1/16	3/4	7/8			1 3/16	1 5/16							1 5/16	
585165-A	100A 230 V 3P UNF	5523	3/4	5 1/2	6 3/16	2		5 1/2		6 3/16	1 7/16		2 1/16	3/4	7/8			1 3/16	1 5/16			1 1/16	1 1/16	1 1/16	1 1/16		
585166-A	100A 230 V 4P UNF	5523	3/4	7 5/16	6 3/16	2			2 5/16	6 3/16	1 7/16		2 1/16	3/4	7/8			1 3/16	1 5/16			1 1/16		1 1/16	1 1/16	1 1/16	
585167-A	100A 600 V 2P FUS	5523	3/4	5	16 5/16	1	5			6 5/16	3 3/16	6 7/16	3 3/16	3/4	7/8	7/8	2	6									
585168-A	100A 575 V 3P FUS	5523	3/4	7 3/16	6 5/16	1		7 1/16		6 5/16	3 3/16	6 7/16	3 3/16	3/4	7/8	7/8	7/8		15/16	6	3/16	3 1/16	3 1/16	3 1/16			
585169-A	100A 575 V 4P FUS	5523	3/4	11	6 5/16	1			11	6 5/16	3 3/16	6 7/16	3 3/16	3/4	7/8	7/8	7/8		15/16	6		1 5/16		1 5/16	1 5/16	1 5/16	
585170-A	100A 600 V 2P UNF	5523	3/4	5	8 3/16	2	5			8 3/16	3 1/16		3 3/16	3/4	7/8			2	1 3/16							1 5/16	
585171-A	100A 575 V 3P UNF	5523	3/4	7 3/16	7 1/16	2		7 1/16		7 1/16	3 3/16		3 3/16	3/4	7/8				1 3/16	1 5/16		3 1/16	3 1/16	3 1/16	1 5/16		
585172-A	100A 575 V 4P UNF	5523	3/4	11	7 1/16	2			11	7 1/16	3 3/16		3 3/16	3/4	7/8				1 3/16	1 5/16				1 5/16	1 5/16	1 5/16	
585173-A	200A 250 V 2P FUS	5523	3/4	4 3/4	16 3/16	1	4 3/4			6 3/16	3 1/16	5 5/16	3 1/16	7/8	1	1 1/16	1 1/16	2	5								
585174-A	200A 230 V 3P FUS	5523	3/4	5 7/8	16 1/16	1		5 7/8		6 1/16	8 3/16	5 5/16	2 5/16	7/8	1	1 1/16	1 1/16		1 5/16	5	5 5/16	2 5/16	2 5/16	2 5/16			
585175-A	200A 230 V 4P FUS	5523	3/4	8 3/16	16 1/16	1			8 3/16	6 1/16	8 3/16	5 5/16	2 5/16	7/8	1	1 1/16	1 1/16		1 5/16	5		2 5/16		2 5/16	2 5/16		
585176-A	200A 250 V 2P UNF	5523	3/4	4 3/4	8 7/16	2	4 3/4			8 7/16	3 3/16		3 3/16	7/8	1			2	1 7/16							1 5/16	
585177-A	200A 230 V 3P UNF	5523	3/4	5 7/16	8 3/16	2		5 7/16		8 3/16	3 3/16		2 5/16	7/8	1				2 1/16	1 5/16		2 5/16	2 5/16	2 5/16	1 5/16		
585178-A	200A 230 V 4P UNF	5523	3/4	8 7/16	8 3/16	2			8 7/16	8 3/16	3 3/16		2 5/16	7/8	1				2 1/16	1 5/16		1 5/16		2 5/16	2 5/16	2 5/16	
585179-A	200A 600 V 2P FUS	5523	3/4	5	19 5/16	1	5			9 5/16	4 1/16	8 1/16	3 3/16	7/8	1	1 1/16	1 1/16	2 1/16	7								
585180-A	200A 575 V 3P FUS	5523	3/4	8 1/16	19 5/16	1		8 1/16		9 5/16	4 1/16	8 1/16	3 3/16	7/8	1	1 1/16	1 1/16		2 1/16	7	3 1/16	3 1/16	3 1/16	3 1/16			
585181-A	200A 575 V 4P FUS	5523	3/4	11 3/16	19 5/16	1			11 3/16	9 5/16	4 1/16	8 1/16	3 3/16	7/8	1	1 1/16	1 1/16		2 1/16	7		1 1/16		1 1/16	1 1/16	1 1/16	
585182-A	200A 600 V 2P UNF	5523	3/4	5	9 1/16	2	5			9 1/16	4 1/16		3 3/16	7/8	1			2 1/16	1 1/16							1 5/16	
585183-A	200A 575 V 3P UNF	5523	3/4	8 1/16	9 1/16	2		8 1/16		9 1/16	4 1/16		3 3/16	7/8	1				2 1/16	1 5/16		3 1/16	3 1/16	1 1/16	1 1/16		
585184-A	200A 575 V 4P UNF	5523	3/4	11 3/16	9 1/16	2			11 3/16	9 1/16	4 1/16		3 3/16	7/8	1				2 1/16	1 5/16		1 5/16		1 5/16	1 5/16		

Copper Alloy Die Castings I

By Allen F. Clark

Fig. 1—Brass die cast parts may incorporate steel inserts

Fig. 2—Aluminum bronze castings resist corrosion

COPPER alloys have brought into the die casting field such new qualities as high strength, rigidity, hardness, resistance to corrosion, ability to withstand shock and abrasion, and absence of aging changes. In so doing, they have broadened the machine designer's conceptions of the utility of die castings. He pictures them today as parts in his designs where, a few years ago, they would have been considered impractical.

From the designer's standpoint, strength is probably the outstanding characteristic of these newer die castings. This characteristic enables the designer to cut down the sizes of his cross sections, to eliminate needless bulk, and often to add a desired touch of beauty that so frequently depends on strength rather than on bulk. These advantages are in addition to those other well-known advantages of all types of die castings: The elimination of machining; the possibility of intricate shapes; and the combination of several parts into one.

In specifying copper-alloy die castings, the designer should bear in mind the same primary rules that apply to zinc and aluminum die casting. Undercuts and sharp corners should be avoided. Generous fillets and webs not only add strength to the part but also assist in producing a better casting. The use of inserts should be confined to those applications where special qualities are required. Lettering can be cast either raised or depressed, but raised letters are less costly from the die construction standpoint. Raised letters in a depressed panel should be considered. The designer can make use of the thinner walls which the die casting process offers.

Gives Minimum Wall Thickness

Minimum wall stocks in a cylindrical portion or the main part of a casting should be 3/32 inch, although portions of a casting may have a 1/16-inch wall. Variations from drawing dimensions must be plus or minus 0.003 inch. Desirable draft on side walls and on cores is 0.020 inch per inch. On the outside walls draft, as is sometimes desirable, may be 0.005 inch per inch of length. The wall intersections should be liberally filletted as should also the area around the base of bosses. Minimum size of cored holes is ⅛-inch diameter. In general, holes from ⅛ to ¼-inch diameter can be cast one and one-half times their diameter in depth; larger holes than this can be cast deeper. External threads, if of coarse pitch, may be cast, but have to be chased, while internal threads cannot be cast. Spur gear teeth of 24 pitch or larger can be cast and then shaved to size.

Inserts may be used in copper-alloy die castings but the material is necessarily limited to steel or iron. Steel inserts frequently provide a method of welding a casting to a tubing or another steel part. Other reasons for the use of inserts include localized hardness at certain points; greater strength at specific points in the casting; bearing qualities; or ease of assembly to component parts.

The production of copper-alloy die castings is

ngs Increase Design Possibilities

divided into two distinct fields—permanent mold or vacuum castings of aluminum bronze and pressure die castings of brass. There are a number of alloys available in each grouping, each of which will answer a specific need of the designer. The exact alloy to be used for a particular application depends, of course, on the application, and should be the subject for discussion between the designer and the manufacturer before the design is completed.

In the vacuum die casting process used in the production of aluminum bronze die castings, the alloy is drawn, by vacuum into a steel die from below the surface of the molten metal. The little aluminum oxide, which is formed on the advancing surface of the metal, is deposited in a thin film upon the walls of the die cavity. Thus, a casting is formed which is free, within its body metal, of aluminum oxide.

The comparatively recent successful development of the second method of fabrication, pressure die castings of brass, has resulted from the availability of alloy steels which would give satisfactory life as dies, and the development of suitable die casting machinery. The relatively high melting point of the alloys formerly made it difficult to secure dies that would resist the temperature long enough to make possible the economical production of brass die castings. Improved machinery development was necessitated because the machines commonly used for other types of die casting are not adaptable to the handling of these alloys.

In the pressure die casting process the metal

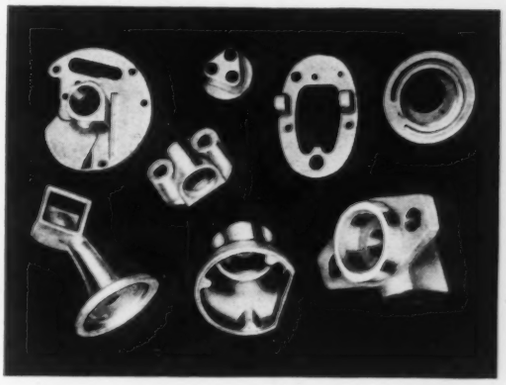
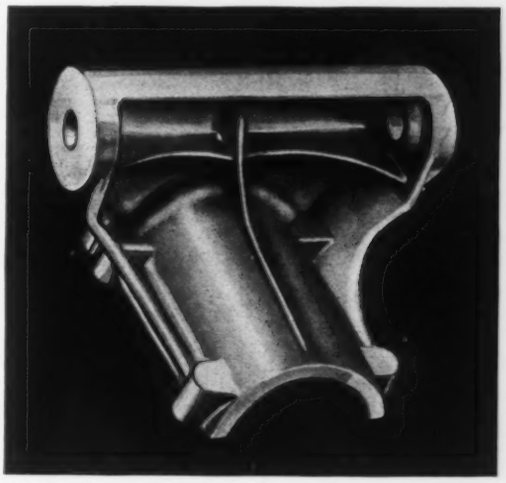


Fig. 4—Machining operations are saved through accurate forming

Fig. 5—Nonferrous die castings will withstand severe strains



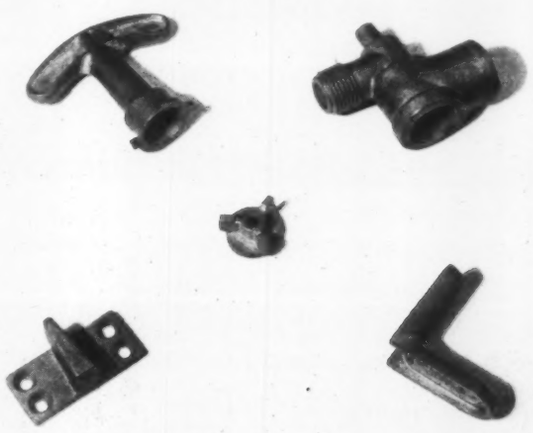


Fig. 3—Quantity production of unusual shapes is made available by pressure casting process

obviously must be maintained for appreciable periods at casting temperature in the holding pot where it is uncovered and subject to continual oxidation by the atmosphere. In the plastic or "'mushy" state, the oxide formed is not readily skimmed from the surface. Addition of aluminum has been found to inhibit this oxidation. The aluminum also reduces the vaporization of zinc in the holding pot and diminishes the deposit of zinc oxide on the die surfaces. The addition of tin increases fluidity of the alloy in casting, tends to inhibit segregation of lead in the holding pot when semiplastic metal is being used and increases the corrosion resistance of the final casting.

Applications of the copper-alloy die castings have been multiplying with startling rapidity. With ample strength and suitable hardness avail-

able, parts which formerly had to be fabricated from steel and similar strong metals by time-consuming machining and finishing processes, may now be die cast to such close dimensions that machining and finishing costs are cut to a minimum. In general, the accuracy attainable exceeds one-half of one per cent of the linear dimensions and, for important dimensions, may be even greater. The applications to date have been quite varied, including various cam shapes, typewriter operating lever handles, spur gears, valve parts, and many others. The following illustrations are worthy of especial attention by the designer.

Permits Use of Thin Blades

The impeller, *Fig.* 2, is used in an electric dishwashing machine and is an example of a part which lends itself readily to the process of die casting in aluminum bronze. The strength of the alloy permits the use of especially thin blades unsupported by ribs that might interfere with the efficient operation of the impeller. Machining is confined to squaring the hub ends and drilling and reaming the center hole. Blade surfaces are cast clean and smooth and the edges uniform so that little finishing is required. Except for appearance, plating is unnecessary as the effective corrosion resistance of the alloy protects it from the ingredients in the dish water.

Inserts of steel or other metal cast rigidly in place, used to improve the quality and usefulness of brass die cast parts, are shown in *Fig.* 1. *Fig.* 4 pictures flanged parts with recesses, bosses and eccentric shapes. Note especially, in the upper right-hand corner, the cast-to-size annular groove, in which an expensive milling operation is saved. *Figs.* 3 and 6 illustrate several types of brass die castings that have been produced in large numbers.

Parts Resist Shock

The resistance of copper alloys to shocks and unusual stresses is demonstrated in the aluminum bronze die-cast swivel bracket for an outboard motor, *Fig.* 5. This bracket withstands the strains of outboard motor racing. The thin sections possible even for this severe service are evident.

Additional examples of copper-alloy die castings would serve merely to emphasize their qualities, whereas, in the limited space available, it is perhaps more important to consider the practical limitations to the adoption of this method of fabrication. Generally speaking, these limitations are concerned more with the economic status of the process than with the physical characteristics of the parts. Naturally, the stronger die castings cost more to manufacture than the lower melting-point white metal die castings. Also, the usually greater cost of dies as compared with the patterns makes die castings slightly more expensive than sand castings. Hence, whenever sand castings are satisfactory and do not require undue machining and finishing, the advantages are ordinarily in favor of the sand castings.

Parts now made from materials of comparable strength and requiring little machining will likewise seldom show marked advantages if redesigned as die castings. However, it is always well to compare all of the properties and advantages of the materials under consideration

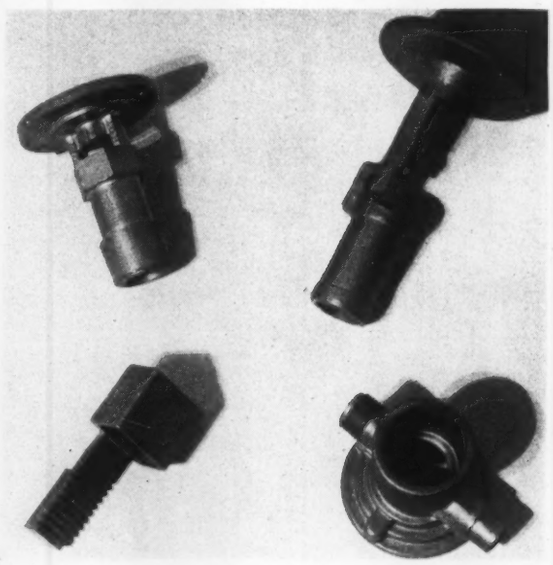


Fig. 6—Racks, intricate shapes or cored holes are possible with copper-alloy parts

before making a final decision. Such properties of copper-alloy die castings as high corrosion resistance and retention of a large percentage of normal strength at elevated temperatures have, in several instances, been factors which rendered them superior to other materials under consideration. In still other cases, it has been a combination of several desirable qualities, rather than any one, that has resulted in the choice of these die castings.

The future field for copper-alloy die castings is quite broad, and would seem to fall into a class of subjects now made of brass or steel which are too intricate for forging and sand cast practice and where the tolerances quoted would permit the elimination of expensive production operations. Also the combination of certain classes of assemblies now made of several stampings where the die casting tool cost would prove an economy over the several expensive stamping dies.

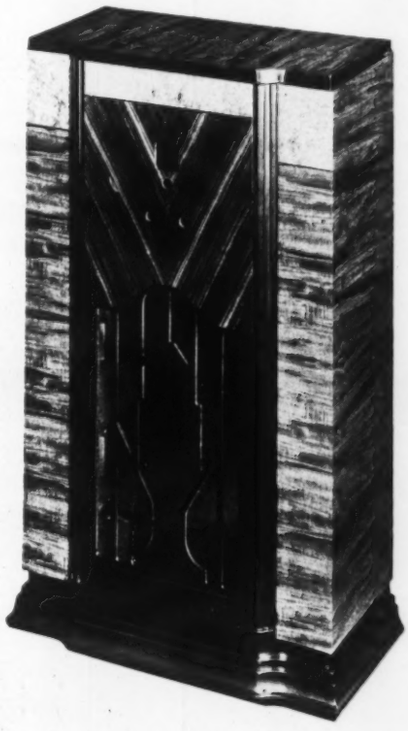
For their considerate assistance in the preparation of this article, MACHINE DESIGN wishes to acknowledge the courteous co-operation of American Brass Co., Aurora Metal Co., and Doehler Die Casting Co. The American Brass company furnished *Figs.* 3 and 6; *Figs.* 2 and 5 are from the Aurora company; while the Doehler company provided *Figs.* 1 and 4.

Prefinished Sheets Extend Design Limits

By Harold B. Veith

STEEL sheets on which the finish coatings have been applied before the material goes into processing operations have captured the interest of engineers in practically all machinery fields. Because designers have become more "finish conscious" in the past few years undoubtedly accounts for this enthusiasm. The innovation offers one avenue for obtaining attractively finished machines employing steel sheets without the expense and labor of applying the lacquer film after the unit has been built. In other words, when the units are being assembled their progress is more expeditious because there has been eliminated the interruptions caused by the usual spraying or enamel baking and other such operations.

One of the striking examples of the strides which prefinished sheets have made is found in the automotive industry. Instrument panels and window trim in many popular makes of cars are formed, stamped and cut from sheets on which a synthetic film of veneer has been applied previously. In addition to the economy of fabricating machine parts directly from the prefinished sheet there is another feature that perhaps is even more inviting. By a photographic process a faithful reproduction of wood grain or other natural effect may be obtained. If the new process offered nothing more than the latter advantage it would be more satisfactory from an appearance standpoint than an attempt to copy grain effects for instance, through priming, graining, lacquering and rubbing.



Striking effects obtained by prefinishing process

Faithful Reproductions Possible

The application of the prefinishing process to sheets also makes possible the covering of the metal with such designs as inlays to give the impression of expensive cabinet work. Four or five color combinations now are available to increase the scope of this accomplishment. In addition to the foregoing, typical reproductions include etched metal, marble and modernistic color designs; even some of the famous paintings have been reproduced with exceptional integrity.

The fields for this material that hold promising possibilities as markets are extensive. Vending machines, air conditioning cabinets, refrigerators, radio cabinets, etc., are only a few of the units that are being considered. Business machines and domestic equipment are particularly adapted to the application of prefinished sheets. Tests made show remarkable resistance of this type of finish in continuous exposure to heat, cold, salt spray and the ultra-violet ray.

The radio cabinet in the accompanying illustration portrays an interesting use for prefinished material. Because this type of unit sometimes embodies a combination of wood and metal the prefinishing process, which can be used on both if desired, gives the designer a wider choice of natural effects with which to work.

Another of the more recent applications for prefinished sheets is the air conditioning cabinet. Sheets that make up this unit are formed and the edges flanged. In assembly the sections are bolted or cold riveted.

The veneer coating, in a process patented by the Di-Noc Mfg. Co., for example, is placed on the sheets in flat form. When this is completed the sheets can be put through any of the various forming and drawing operations. The finish is not marred by the dies. Users of this material point out that the coating will withstand without fracture or distortion any forming operation that the sheet will undergo successfully.

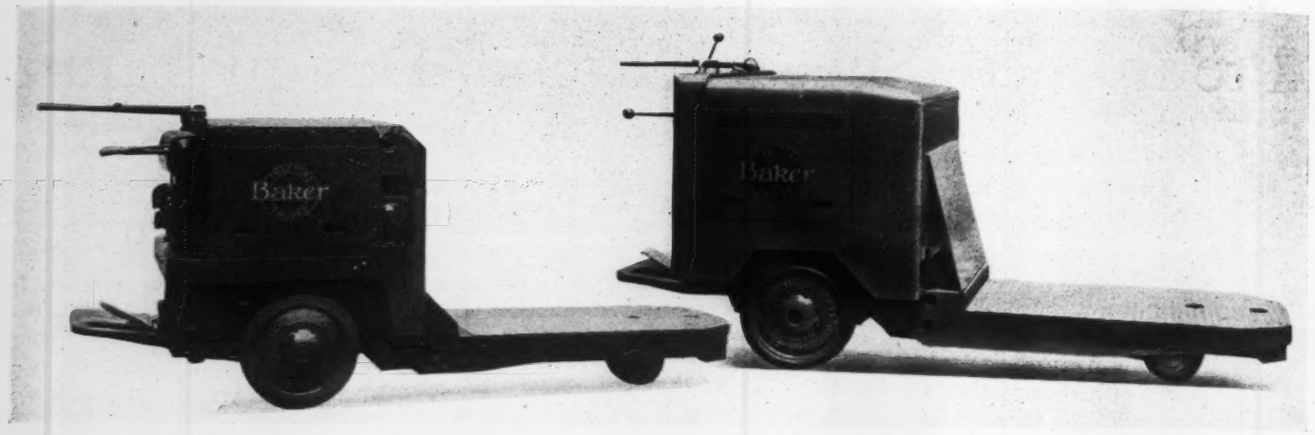


Fig. 1—In the development of the new design of industrial truck, right, protruding units or parts on former models, left, have been completely eliminated, thus affording greater safety for the operator

Enclosures Improve Appearance, Increase Utility

STREAMLINING is not a new thought. It has been proposed from time to time for a number of years, but until recently the great majority of designers has chosen to ignore it. Today, one finds the pendulum swinging in the opposite direction. The influence of streamlining is such that attention to appearance in industrial machinery has become a major design problem. Mechanisms are being enclosed, bulky outlines are being smoothed out and practical "streamlining" in all its forms, from the more spectacular motor cars and trains to the modified designs of completely utilitarian shop tools, is assuming its proper place in design. The surprising factor in the change is that it has been found that attention paid to appearance not only enhances the beauty of the machine, but also materially increases efficiency, ease of design, and accessibility.

Decreases Possibility of Accident

For example, in the design of the three-ton elevating truck of Baker-Raulang Co., right of *Fig.* 1, it was found that the attractive, completely enclosed design considerably decreased the possibility of accident, and actually improved the accessibility of many parts. As can be seen from the earlier design, left of *Fig.* 1, the enclosure of battery box and controls has eliminated protruding units or parts against which the operator might be thrown in the event of the truck's hitting some obstruction.

The consideration of safety in this industrial truck does not end with these more apparent features. Both the possibility of the operator dropping off the platform while the truck is still in motion and letting it run wild, and that of starting the truck with the controller in an advanced position allowing it to jump away, are guarded against by an electrical interlock. First, the truck will not run without pressure on the foot pedal. Further, the travel controller is interlocked with the foot brake in such a way that the circuit is opened when the brake is applied and can only be closed by returning the controller to neutral and releasing the brake.

A further safety provision is the adoption of a gate-type stop on the controller operating lever. With the use of the latch-type stop previously employed, it was possible to jam the lever through from highest speed forward to reverse in a fraction of a second. The gate-type stop requires at least a momentary pause between forward and reverse and thus protects the motor and equipment from sudden reversals.

Consideration of the operator also suggested the installation of roller bearings at top and bottom of the steering mast, and special needle bearings, selected because of space considera-

tions, in many of the steering rod connections, thus increasing ease of steering and maneuverability. Also, a sponge rubber pad installed on the operator's platform decreases fatigue under long hours of operation.

All sliding contacts between the drive axle and the chassis have been eliminated by the use of patented Duplex Compensating Suspension in which the axle is suspended by torque and drive yokes, top right, *Fig.* 3, which permit the free motion of the axle over uneven floors without transmitting jars or shocks to the frame of the truck. The reason for the selection of this compensating suspension over the typical railway axle suspension, top left of *Fig.* 2, is that in this

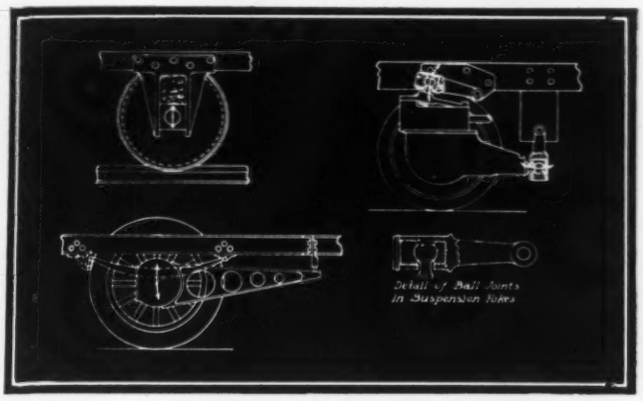


Fig. 2—Torque and drive yokes support the axle in duplex compensating system which eliminates springs

latter type of suspension wear occurs on the arms of the fork and there is a consequent forward and back sloppy motion. In the typical torque arm automobile axle suspension, bottom left of *Fig.* 2, the arm takes some of the driving and braking forces set up by the truck and the remainder of these forces must be taken by the spring. A familiar replacement for this type of spring suspension is the Hotchkiss type of automobile axle suspension, but in this type the springs take the entire force of the various driving and braking reactions. To obviate the results of these severe actions on the spring, the compensating system, top right of *Fig.* 2, was adopted. In this system, the upper yoke, *A* in *Fig.* 3, takes the thrust forces while the lower yoke, *B* in *Fig.* 3, resists the driving and braking torque. The yokes are connected by ball and socket joints to the axle assembly and through bronze bushed joints to the truck frame.

The rubber piles which can be seen in *Fig.* 3, top, act as springs and replace helical springs formerly used. These resilient piles have the same shock absorbing ability as the springs and eliminate the possibility of breakage. They are made up of a series of rubber "doughnuts" combined alternately with iron plates, rather than a continuous rubber tube which might bulge too greatly under load. The truck frame sits on top of this rubber pile while above the frame and on the same spring bolt as the lower rings are small rubber rings and washers employed to dampen out the rebound.

Employs Worm Drive Principle

The power axle employs the worm drive principle of 17½ :1 ratio with a hardened and ground alloy steel worm working on a bronze wheel and a four-pinion differential with ball bearings used wherever space permits. Axle shafts are full-floating with universal joints enclosed in boots of heavy canvas which keep out dust and grit. Driving wheels turn on drop forged knuckles, selected for strength in the replacement of earlier cast parts, while they are mounted on deep groove ball bearings, adopted as a further step in the elimination of chatter. Trailing wheels turn on alloy steel knuckles and are each mounted on two adjustable tapered roller bearings. The trailing axle which must carry much of the load has been redesigned of alloy steel.

Compactness has been made possible in the design of this truck by the adoption of a lift-

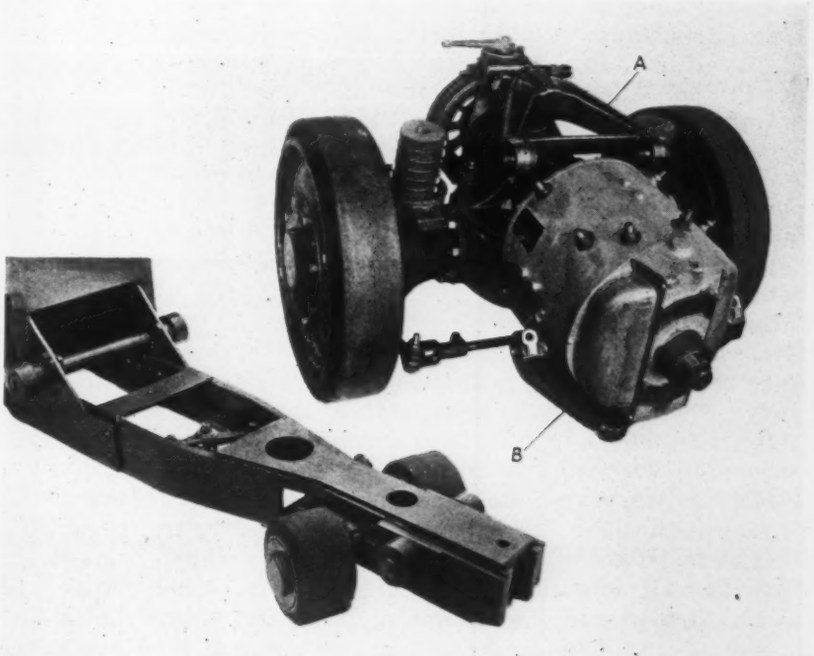


Fig. 3—Rubber piles take the minor shocks generated by the truck passing over irregularities in the floor

ing mechanism that would take the lift unit away from underneath the platform and permit its enclosure. Rather than use a system of toggles or an elevating screw for raising the platform, the lifting unit employs inclined planes for the lifting action. These planes work against the two sets of rollers on the trailing frame shown in *Fig.* 3. As the platform is pulled backward, through the action of roller chains running over hardened steel sprockets, it is lifted by the force of the rollers against the inclined planes. Return is by gravity, the hoist motor being shunted on lowering to prevent too rapid return of platform.

The lift unit itself embodies a combination spur gear and planetary reduction with the hardened, cut-steel gears running in oil in a completely enclosed case. The unit is mounted in a high position in the platform end of the

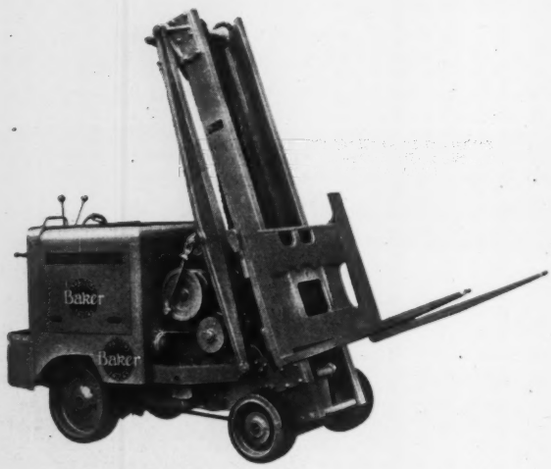


Fig. 4—*Fork model truck makes use of many of the parts employed on the lift truck shown in Fig.* 1

battery compartment and, as there are no working parts under the platform, there is no possibility of harming the lift unit by running in sand or in dust-laden air. Both upper and lower limits of operation are protected by the limiting operation of the lift controller.

Two motors, for travel and lift, have been designed by the maker of the truck especially for use in industrial trucks. They are totally enclosed in rolled steel cases and the armature shafts turn on ball bearings. In order to prevent the possibility of motor leads breaking off, thus necessitating a complete overhaul, motor leads are brought out through studs on the motor case, *Fig.* 3, these studs being fitted into square broached holes in the case. Flexible couplings are used with all travel motors.

In the improved enclosed design, it might be thought that the lubrication of shafts and bearings would be a difficult feat. This is not so, however, as all points needing lubrication are fitted with high-pressure greasing nipples, and these nipples have been so placed that they may be reached easily through the openings available when covers in the body are removed.

Electric welding has been employed in the fabrication of the frame of the truck, *Fig.* 3. While welding gives a rigid and strong frame, its use for all connections was not practical in view of the production problems which confront the manufacturer. All trucks of this model do not employ the same trailing frame or even the same parts of it, but even though these trailing frames may change, the frame under the power compartment remains the same. The connection between the two assemblies is made by riveting with electrically heated rivets through reamed holes, and different standard assemblies can be so connected without the need for special jigs or special production operations.

The possibility of different types of trailing frames being used brings up the fact that the maker of industrial trucks is faced with a production problem that the designer must solve. Industrial trucks vary between wide extremes as they may be required to perform a widely varying type of material handling, and the production in any one group is not high. Therefore, it rests with the designer to develop trucks for special tasks that will not require too expensive a variance in manufacturing procedure.

Standard Parts System Adopted

To overcome this problem, the designers of the Baker company have adopted a policy of interstandardization. Following this precept, new trucks are developed by combining proved units in a frame of new design. Drive axles, electric brakes, wheels, controllers, etc., are standard for all models. Also, the drive axle used in the truck presented in this article is adapted to a number of different purposes. For example, a drive axle may be used, without the differential, for operating a hoist by replacing the wheels with cable drums or chain sprockets, or a drive axle in its entirety may be employed to operate two winches with the option of operating either one controlled by an electrically operated disk brake on each drum. The adaptation of the standard parts for the battery compartment of the lift truck being discussed to a fork truck may be seen from *Fig.* 4. In this truck a further step in the interstandardization is the modification of the hoist mechanism in the lift truck for the hoist mechanism in the fork truck and a further modification of this same hoist unit in the lift truck for the tilting mechanism in the fork unit. The drive axle is built up of a standard bowl containing the differential, and standard yokes for the steering knuckles. By employing different spacers and axle shafts, axles built of substantially similar parts can be accommodated to varying treads necessary in different models. Similarly double drum winches or hoist units can be built having practically an unlimited variation of drum center distances.

Adapting Phorograph Method to Accelerations

By M. F. Sayre
Associate Professor of Applied Mechanics, Union College

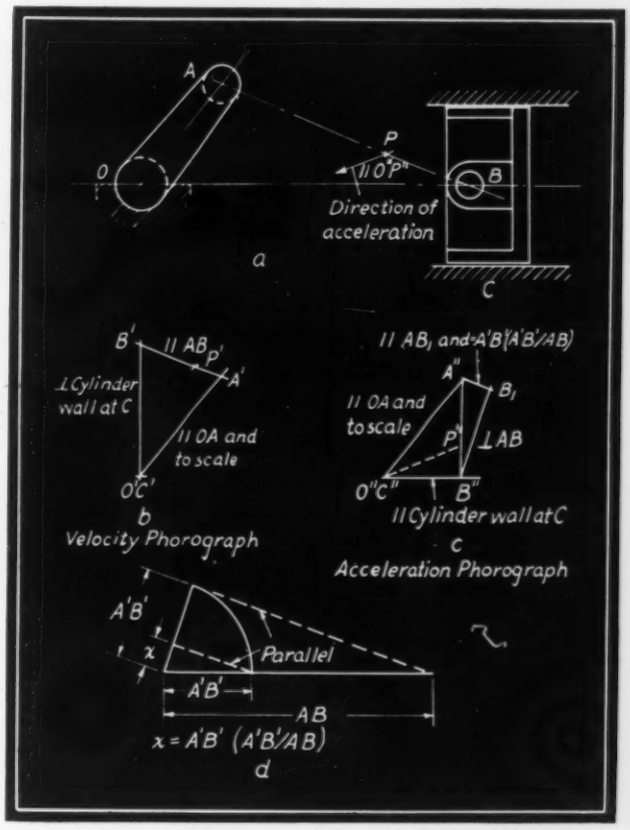


Fig. 1—Acceleration forces are of immediate importance in gas engine crank and piston assembly

THE phorograph method for solving graphically for velocities in machine mechanisms (M. D. Sept. p. 24), originally developed by Professor Angus, may be used with modifications for the study of accelerations and of acceleration forces. The problem is more complex than when dealing with velocities only, but accelerations at times play such an important role in connection with proper design and operation of machinery that the extra time for their determination may well be spent.

In an acceleration phorograph diagram, as in a velocity phorograph diagram, some one member of the machine—preferably but not necessarily one rotating at relatively constant speed—is chosen as a reference link. Each point on this reference link is subject to so-called centrifugal, or more accurately centripetal, acceleration, acting at any moment radially toward the center of rotation, and equal in amount to $R\omega_o^2$, where R is the length of the radius, and ω_o is the angular velocity of the reference link in radians per second. The acceleration of any desired point on the machine elsewhere than on the reference link is now indicated by locating that point on the reference link which accelerates in the same direction and at the same rate as the original point on the machine. This point is called the acceleration image of the original point.

Two Types Considered

Two types of accelerations are best considered separately: First, those present in the machine even when the controlling member of the machine, the reference link, is traveling at uniform speed; and second the additional accelerations which will result from changing speeds in this controlling member. The second component may be obtained directly from the velocity phorograph diagrams described in the preceding article, with almost no modifications. The first calls for the use of the 'acceleration phorograph' diagram just mentioned. This component is usually much the more important of the two.

Reference Link at Constant Speed

The methods used may be best understood by starting immediately with a practical case, as for instance a gas engine crank, connecting rod and piston assembly as shown in *Fig.* 1*a*. Here acceleration forces are of immediate importance, both the acceleration forces on the connecting rod, which place it in bending and which control its design, and also the acceleration forces on the piston, which materially affect from moment to moment the magnitude of the torque exerted upon the shaft.

The crankshaft OA would naturally be chosen

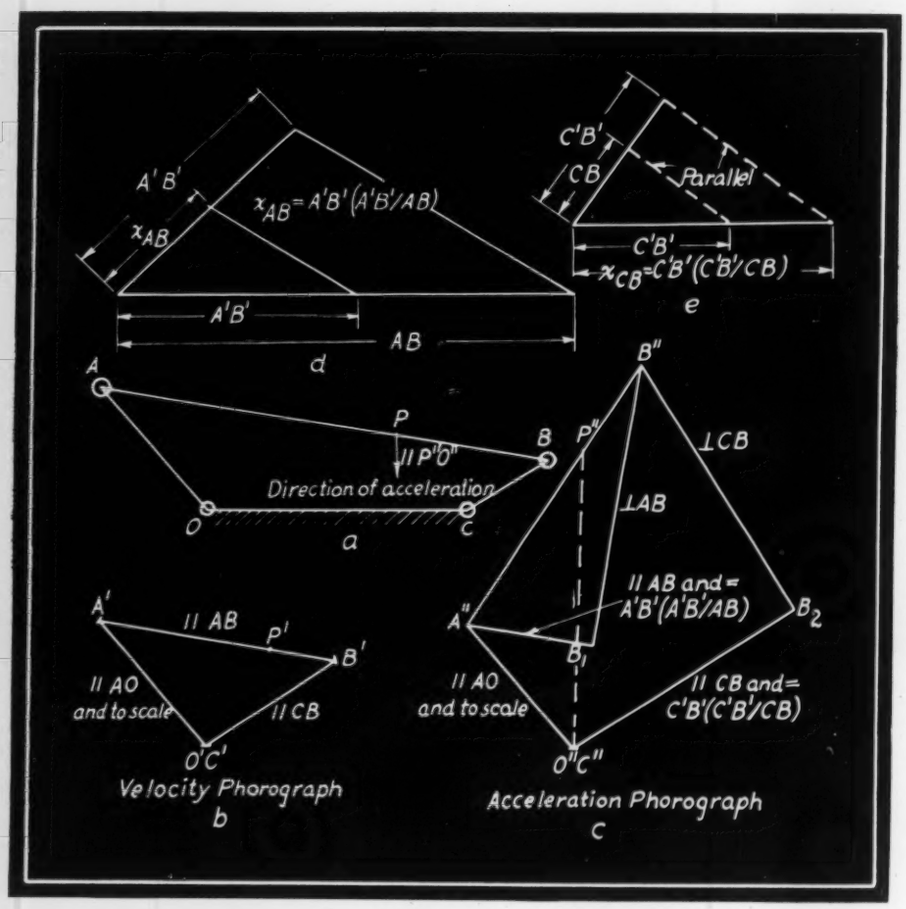


Fig. 2—In each case there is a reference link and a second stationary point in the mechanism

as the reference link for this machine. The velocity phorograph diagram is shown in *Fig.* 1*b*. In the acceleration phorograph diagram, *Fig.* 1*c*, the image of the reference link obviously should be identical in shape and size to the reference link itself, so that $O''A''$ is parallel to OA and equal to it in length. C'', the image of C, coincides with O'' since it also is a stationary point. With respect to C, B evidently is constrained to accelerate only in a horizontal direction. Its image must therefore lie on a horizontal line drawn through C''. With respect to A, B has an acceleration in a centripetal direction (from B toward A) equal $AB \times \omega_{AB}^2$, and also a tangential acceleration at right angles to AB of unknown amount. ω_{AB}, the angular velocity of the link AB, can be found by making use of the velocity phorograph diagram, using principle VII which follows:

Gives Angular Speed Data

VII. The angular speed n or ω of any link as AB at any one moment will equal the angular speed n_0 or ω_0 of the reference link, multiplied by the ratio of the length of the image $A'B'$ to the original length AB.

The corresponding centrifugal acceleration of A with respect to B is therefore given by the following formula:

$$AB\omega_{AB}^2 = AB(A'B'/AB)^2\omega_0^2 = A'B'(A'B'/AB)\omega_0^2$$

The value of $A'B'$ $(A'B'/AB)$ can readily be found analytically or graphically by various methods, one of which is indicated in *Fig.* 1*d*. The effect of this centrifugal component may be shown in *Fig.* 1*c* by drawing the line $A''B_1$ parallel to AB and equal in length to the quantity which has just been found.

To represent the tangential component, draw a line through B_1 perpendicular to AB. It will intersect the horizontal line through C'' at B'', which is the true acceleration image of point B. The image of the connecting rod AB would be represented by line $A''B''$ and any point P on this connecting rod placed, for instance, one-third of the way from B toward A would have its image at P'' one-third of the way from B'' to A''. The acceleration of point P acts in the direction from P'' to C'' and equals this length times ω_0^2. The acceleration of the piston itself at this particular moment equals $O''B'' \times \omega_0^2$. Similarly, the acceleration of any other point on the machine may be found by this procedure.

Select Second Stationary Point

Figs, 2, 3, 4 and 5 show similar diagrams for other mechanisms. In each case OA acts as the reference link and C is a second stationary point. In *Fig.* 2, after locating points O'', A'', and C'' lines $A''B_1$ and $C''B_2$ are drawn parallel respectively to AB and CB and equal to $A'B'$ $(A'B'/AB)$ and $C'B'$ $(C'B'/CB)$. This takes care of the centripetal accelerations in AB and CB respectively. The tangential accelerations are cared for by drawing lines perpendicular to AB through B_1 and perpendicular to BC through B_2. These lines intersect at the true acceleration image, B''.

In the quick return shaper mechanism of *Fig.* 3, line $O''A''$ on the reference link is drawn parallel to OA and equal to it to doubled scale. C and G both are stationary points so that their

images C'' and G'' coincide with O''. B is a point on CD immediately below point A on OA, and accelerates with respect to A parallel to the slot on CD so that line $A''B''$ must be parallel to this slot. The centripetal component of the acceleration of B with respect to C is represented by $C''B_1$, equal to $C'B'$ $(C'B'/CB)$. Its tangential component is represented by a line through B_1 perpendicular to BC. The true acceleration image B'' lies at the intersection of this line with the line $A''B''$.

The image of the link CBD must be a figure precisely similar in shape to the link itself. Having located the two points C'' and B'', the image of D'' can be found easily by following this procedure.

Outlines Steps in Solution

Through D'' draw a line $D''E_1$ parallel to DE and equal in length to $D'E'$ $(D'E'/DE)$. Through G'' draw a horizontal line to represent the relative acceleration of E with respect to its slide G and through E_1 draw a line perpendicular to DE, to represent the tangential component of the acceleration of E with respect to D. The true image E'' lies at the intersection of these two lines. The tool F moves at the same velocity and with the same acceleration as E so that its image F'' coincides with E''. Its acceleration will equal $O''F'' \times \omega_0^2$.

Figs. 4 and 5 have been drawn using the same methods. The general principles involved in drawing these acceleration phorograph diagrams are as follows:

IX. The acceleration image of the reference link is a figure precisely similar to the reference link and equal to it in size, to scale.

X. The acceleration images of all stationary points on the machine are concentrated at the one stationary point on the reference link.

XI. If any link AB rotates at uniform speed $\omega = A'B'/AB \times \omega_0$, the line connecting the acceleration images A'' and B'' will be parallel to AB, and equal in length to $A'B'$ $(A'B'/AB)$. If the link has an angular acceleration α but a zero angular velocity, the line connecting the images A'' and B'' will be perpendicular to AB and equal in length to $AB \times \alpha/\omega_0^2$. If both velocity and acceleration are present, the line $A''B''$ can be thought of as the hypotenuse of a right triangle composed of a centripetal component $A''B_1$ parallel to AB and equal to $A'B'(A'B'/AB)$ and of a tangential component B_1B'' perpendicular to AB.

XII. The acceleration image of any one link on the machine will therefore be a figure precisely similar in shape to the link itself. It will in general be larger or smaller than the link itself and may be shifted in direction

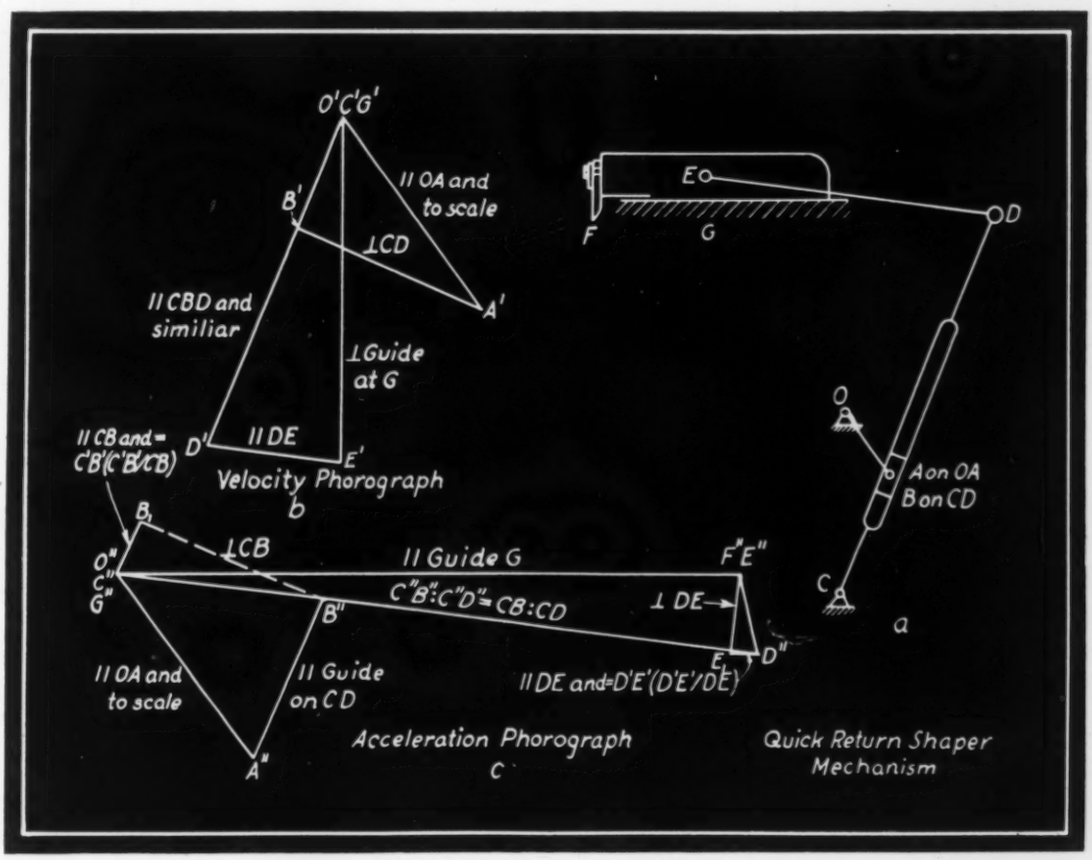


Fig. 3 — In quick return shaper mechanism the image of the link must be a figure precisely similar in shape to the link itself

through any given angle depending upon the comparative values of ω and α, but all dimensions will be proportional. Using this principle, if the image of any one side of the link is known, the image of the whole link can be drawn.

XIII. Divide the machine, beginning at the reference link, into a series of one or more short chains of links, each chain starting at a point of known acceleration (possibly zero acceleration) and ending at a similar point of known acceleration. Starting from both ends of each chain, draw lines corresponding to the centripetal component of each link, which by principle XI are known both in direction and amount ($O''A''$, $A''B_1$, and $C''B_2$ in *Fig.* 2; or $O''A''$ and $O''B_1$ in *Fig.* 3). In all but especially complex cases, where cut and try methods will be necessary, the acceleration image of the chain of links can be completed by drawing lines to represent two remaining tangential components, which are known in direction but not in amount (B_1B'' and B_2B'' in *Fig* 2; or $A''B''$ and B_1B'' in *Fig.* 3).

By making use of principles XII and XIII, the next succeeding chains can now be drawn (*BD, DE* and *EG* in *Fig.* 3; *BD, DE* and *EF* in *Fig.* 4), and so on.

XIV. Making use of the acceleration phorograph diagram so drawn, the relative acceleration of any one point *A* on the machine with respect to any other point *B* whatsoever on the machine will always be in the direction of the line $A''B''$ connecting their images and numerically will equal $A''B'' \times \omega_0^2$. If one of these two points is fixed in position, as point *O*, the absolute acceleration will be given.

XV. To find the angular acceleration α in radians per sec.^{2}, of any link *AB*, draw through A'' a line parallel to *AB*. From B'' drop a perpendicular, intersecting this line at B_1. Then $B''B_1$ will represent the tangential component of the acceleration of *B* with respect to *A*, and α will equal $B''B_1 \times \omega_0^2/AB$.

Accelerations Due to Change in Speed

So far it has been assumed that the reference link has been moving at uniform speed. Usually this can be assumed to be the case and the accelerations computed directly in the manner shown. Sometimes, however, it is necessary to take into account the fact that the reference link itself is accelerating or decelerating. In this case it is probably simplest to compute separately for any one point the acceleration resulting from changes in speed of the reference link, and then to combine it with the other component of the acceleration, computed as described in the foregoing. By making use of the velocity phorograph diagram, this can be done relatively easily. Change in speed in the reference link acts to change the speed of every other link on the machine proportionately. If for instance α_0, the angular acceleration of the reference link, is ten per cent of ω_0, its angular velocity, linear acceleration a_P of any point *P* on the machine would equal ten per cent of its velocity v_P. In other words, it would equal $O'P' \times \alpha_0$, since this in turn is ten per cent of $O'P' \times \omega_0$, and similarly for any other relative relation between α_0 and ω_0. This acceleration acts to increase the amount but not the direction of the velocity and so acts in the same direction as the velocity. The following general statement can therefore be made:

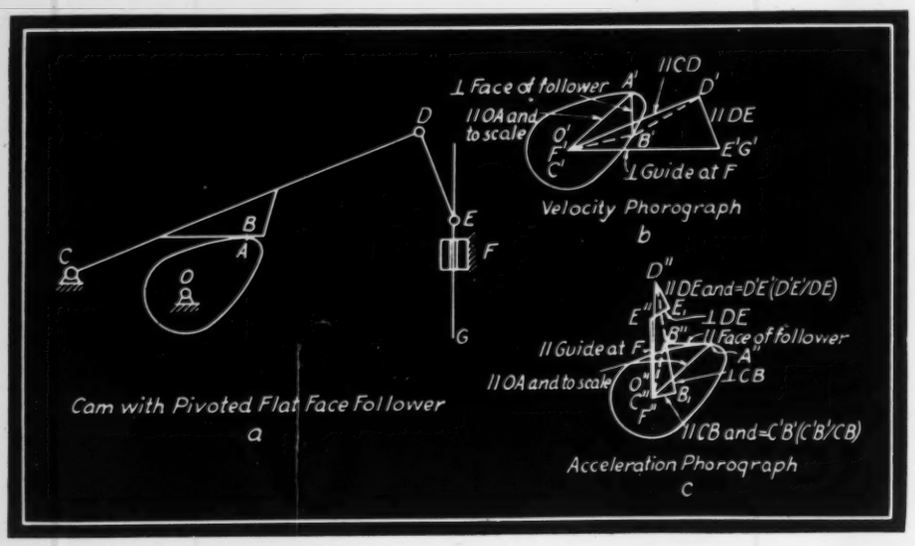


Fig. 4—The acceleration images of all points on the machine are concentrated at the one stationary point on the reference link

XVI. If the controlling member of the machine, chosen as the reference link, moves with other than uniform speed, the resulting relative acceleration of any point with respect to any other point whatsoever on the machine is always perpendicular to the line connecting the images of the two points on

the velocity phorograph diagram, and is numerically equal to the length of this line, multiplied by the angular acceleration α_o of the reference link in radians per sec.^{2} If one of these points is stationary, absolute rather than relative accelerations will be obtained.

This of course refers only to that part of the total acceleration of the point P which results from the change in speed of the reference link. The total acceleration would equal this component $O'P' \times \alpha$ acting perpendicular to $O'P'$, plus the other component $O''P'' \times \omega_o^2$ acting in the direction P'' toward O''.

For any one particular pair of values of ω_o and α_o, these two acceleration components may be combined when drawing the acceleration phorograph diagram. To do this, when finding the image of the first point A on the reference link, lay off $O''A_1$, equal and parallel to OA. From A_1, at right angles to OA and in the opposite direction to that in which the reference link is accelerating, lay off A_1A'' equal to $OA \times \alpha_o/\omega_o^2$. Draw the balance of the acceleration phorograph diagram just as before. For any point as P on the machine, the true total acceleration will equal $O''P'' \times \omega_o^2$, acting in the direction from P'' toward O'', and the component $O'P' \times \alpha$ need not be separately considered. Obviously this solution is a special one, applying only to this particular ratio of α_o/ω_o^2.

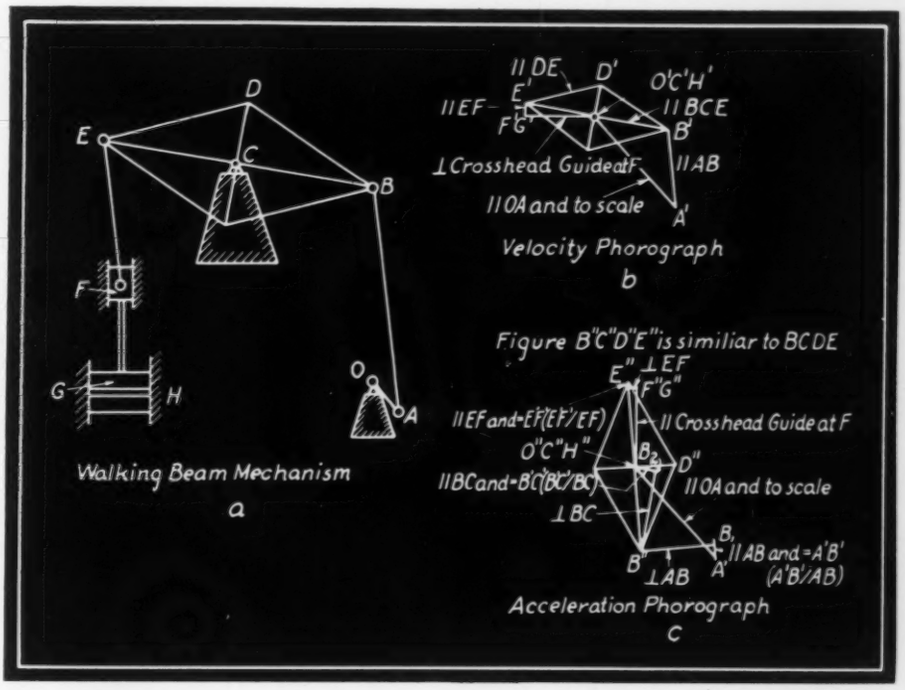


Fig. 5—Acceleration image will, in general, be larger or smaller than the link itself and may be shifted in direction through any given angle depending upon comparative values

Defines Acceleration Force

The acceleration force or inertia force upon a machine at any point of course acts opposite in direction to the acceleration, and equals the mass at that point multiplied by the acceleration, or ma/g. The acceleration phorograph diagram gives a true picture of the way in which these forces act, showing for instance the forces upon the connecting rod in *Fig.* 1 as being a distributed load, varying in intensity from point to point, and in direction radiating out from an imaginary common center. Practically, in computing stresses in the connecting rod it may be necessary to use some arbitrary simplification of these true conditions.

By using proper scales for the drawings, this graphical solution can be made sufficiently precise for use in nearly all cases. Alternatively it may occasionally be desirable to use it to obtain a general picture of relationship in a machine, upon which a quantitative mathematical solution may be based in later, more extended calculations.

Walking Beam Pump Is Replaced

ACQUISITION of an ancient "walking-beam Cornish pump" is being considered as a relic by the city of Iron Mountain, Mich. The unit now is located on the surface at the Ludington shaft of the Chapin mine near that place. City officials wish to have it for sentimental reasons and for the more substantial reason that this giant pumping engine of a past era is a relic of the first magnitude and would attract many tourists to Iron Mountain. The pump might have been operated longer at the mine had it been possible to adapt it to an electric motor drive; however, it has been replaced by centrifugal pumps. It was designed for a capacity of 5,000,000 gallons each 24 hours, against a 1500-foot head at the low speed of 10 revolutions per minute. Its designer was Edwin Reynolds, one of the outstanding engineers of his day. Another instance of the romance that pervades machinery development.

Chromium Irons Combat Heat, Corrosion

HIGH chromium irons are finding heat-resisting service applications where gray and alloy gray irons will not withstand the service conditions and where the more highly alloyed nickel-chromium and other types are considered too expensive. In some instances, the high chromium irons are better suited than other materials tested, in the opinion of Garnet P. Phillips, metallurgist for Frank Foundries Corp., who spoke on "High Chromium Cast Irons" at the meeting of the American Foundrymen's association.

The high chromium irons have about the same coefficient of thermal expansion as ordinary gray iron. Tensile strength of the metal decreases with increasing temperature over about 1000 degrees Fahr. At about 1800 degrees Fahr., approximately 10 per cent of the as-cast tensile strength is retained.

Castings poured with high chromium irons should be as uniform as possible in metal section. Very heavy sections should not be used. Abrupt changes in metal sections and sharp corners should be avoided. Ordinarily the sections cast will be between 5/16 and ¾-inch. Uniformity of section is extremely important in preventing "heat cracking" due to differences in expansion and in varying metal sections. It is recommended that all of the high carbon types be annealed to relieve casting strains before being put into service. The material may be used regularly at temperatures up to 1800 degrees Fahr., and for short periods up to 1900 degrees Fahr.

These irons have good resistance to atmospheric corrosion, and to nitric, sulphuric and mixtures of nitiric and sulphuric acids. They have been found reliable for dilute phosphoric and lactic acids, for numerous salt solutions, and for caustic soda solutions. In contact with molten lead and aluminum they have given excellent service with practically no warpage.

In general, the lower carbon grades are the more corrosion resistant. The corrosion resistance has been found to decrease with increasing carbon content, although this may be partially offset by increase of the chromium content. The outstanding characteristics of the high chromium irons are their excellent growth and oxidation resistance. In addition, the high carbon grades have very good abrasion resistance so that their field of application should broaden considerably.

Gives Typical Analyses

Typical chemical analyses and physical properties of high chromium cast irons are given in the accompanying table. Transverse tests were made on 1.20-inch diameter bars tested on supports 18 inches apart. Modulus of rupture and ultimate modulus of elasticity were calculated from the transverse test data. Hardness tests were made on sections taken from the broken transverse test bars. Rockwell hardness values are the average of four tests in each case. Tensile tests were made on 0.80-inch diameter bars machined from transverse test bars.

Irons such as 1, 2 and 3 in the table are drilled and cut readily, but are rather difficult to grind. Irons such as 4 and 5 are more difficult to machine, the difficulty increasing with increasing

(*Concluded on Page* 68)

Physical Properties of Some High Chromium Irons

No.	Si.	C.	S.	P.	Mn.	Cr.	Ni.	Transverse test Load— lbs.	Deflection— Inch.	Modulus of Rupture— lbs. per sq. in.	Modulus of Elasticity— lbs. per sq. in.	Tensile Strength— lbs. per sq. in.	Hardness Rockwell	Brinell
1.[1]	0.85	0.93	0.040	0.057	0.30	31.40	.....	3450	0.175	91,528	23,949,252	52,140	C34.8	302
								3000	0.150	79,590	23,949,252	47,440	C34.4	293
2.	1.43	0.78	0.030	0.090	0.95	33.70	.....	1880	0.100	49,876	22,500,000	32,500	B104	262
3.[2]	1.05	0.72	0.090	0.090	0.41	24.84	.....	4040	0.27	107,181	17,900,000	47,900	B97.5	228
								2865	0.19	76,000	17,900,000	41,720	B95.5 Edge B85.5 Midway—170 and B41.0 Center — 153	
4.[3]	1.18	1.57	0.109	0.107	0.31	24.70	.....	4670	0.23	124,000	24,200,000	73,800	C39.5	363
								3770	0.17	100,018	26,500,000	69,540	C37.2	321
5.[4]	1.96	1.84	0.057	0.032	0.65	23.95	0.42	4285	0.19	113,600	26,900,000	85,600	B108.2	341

[1] No. 1 iron made with nitrogen bearing ferrochrome. The two sets of values of physical properties were obtained on finer grained and coarser grained specimens respectively.

[2] The two sets of values of physical properties given for iron No. 3 are for finer grained and coarser grained specimens respectively.

[3] The two sets of values of physical properties for iron No. 4 are for "as cast" and annealed specimens, respectively. Annealed specimen of iron No. 4 annealed at 1850 degrees Fahr. for 3 hours and slowly cooled.

[4] No. 5 iron annealed at 1800 degrees Fahr. for 3 hours and slowly cooled.

New Machines Indicate Design Trends

JUST a few years ago if a designer were asked what he had done to improve the appearance of his machine, he would have thought the question referred to the type of paint employed. All this has been changed, however, as evidenced by the excellent enclosed designs that have been presented in the illustrated feature (see following two pages) during past months. The trend is toward practical enclosures that enhance the beauty of the machine.

Even though designers are beginning to pay stricter attention to appearance, few realize the sales value of this factor. Designs for style or appearance can be patented, see page 15, and many manufacturers have found this to be the best policy to follow. Also, improvement in this respect often provides engineering advantages, page 28.

Machines recently announced in addition to those on the next two pages include the following, arranged by fields of application:

Air Conditioning

Unit Conditioner,
Savage Arms Corp.,
New York.

Bottling

Cleaning, Filling and Capping Machine,
Pneumatic Scale Corp.,
Norfolk Downs, Mass.

Brewery

Small Bottle Washer,
Twentieth Century Machinery Co.,
Milwaukee.

Bung Extractor,
Maynz & Co.,
New York.

Confectionery

Coating Machine,
Sanidip Mfg. Co.,
Springfield, Mass.

Construction

Two-Stage Portable Compressor,
Schramm Inc.,
West Chester, Pa.

Gasoline Hammer,
Barco Mfg. Co.,
Chicago.

Concrete Grinding Machine,
American Floor Surfacing Machine Co.,
Toledo, O.

Dairy

Cream Separator,
Westfalia Separator Co.,
Bloomfield, N. J.

Two-Stage Can Washer,
Oakes & Burger Co.,
Cattaraugus, N. Y.

All-Metal Churn,
Jensen Creamery Machinery Co.,
Bloomfield, N. J.

Domestic

Ironer,
Westinghouse Electric & Mfg. Co.,
Mansfield, O.

Washing Machine,
Landers, Frary & Clark,
New Britain, Conn.

Vacuum Cleaner,
Westinghouse Electric & Mfg. Co.,
Mansfield, O.

Glass

Tilting Mixer,
T. L. Smith Co.,
Milwaukee.

Industrial

Lift Truck,
Barrett-Cravens Co.,
Chicago.

Dust Filter,
W. W. Sly Mfg. Co.,
Cleveland.

Unit Heater,
Modine Mfg. Co.,
Racine, Wis.

Vacuum Cleaner,
Invincible Vacuum Cleaner Mfg. Co.,
Dover, O.

Gasoline Tractor,
Lansing Co.,
Lansing, Mich.

Portable Floodlight System,
Homelite Corp.,
Port Chester, N. Y.

Laboratory

Centrifugal,
Bird Machine Co.,
South Walpole, Mass.

Metalworking

Board Drop Hammer,
Chambersburg Engineering Co.,
Chambersburg, Pa.

Hydraulic Die Casting Machine,
Lester Engineering Co.,
Cleveland.

Milling Machine,
Van Norman Machine Tool Co.,
Springfield, Mass.

Turrett Lathe,
Warner & Swasey Co.,
Cleveland.

Hand Grinder,
Dumore Co.,
Racine, Wis.

Hydraulic Surface Grinder,
Hill Clutch Machine & Foundry Co.,
Cleveland.

Office

Duplicator,
Milo Harding Co. Ltd.,
Los Angeles, Calif.

Portable Typewriter,
Underwood Elliott Fisher Co.,
New York.

Packaging

Seal Strip Labeler,
Edward Ermold Co.,
New York.

Bag Stapler,
Bates Mfg. Co.,
Orange, N. J.

Wire Tying Machine,
Gerrard Co. Inc.,
Chicago.

Power Boating

Centrifugal High-Pressure Pumper,
Outboard Motors Corp.,
Milwaukee.

Marine Engine,
Scripps Motor Co.,
Detroit.

Steelmaking

Constant Weight Feeder,
Hardinge Co.,
York, Pa.

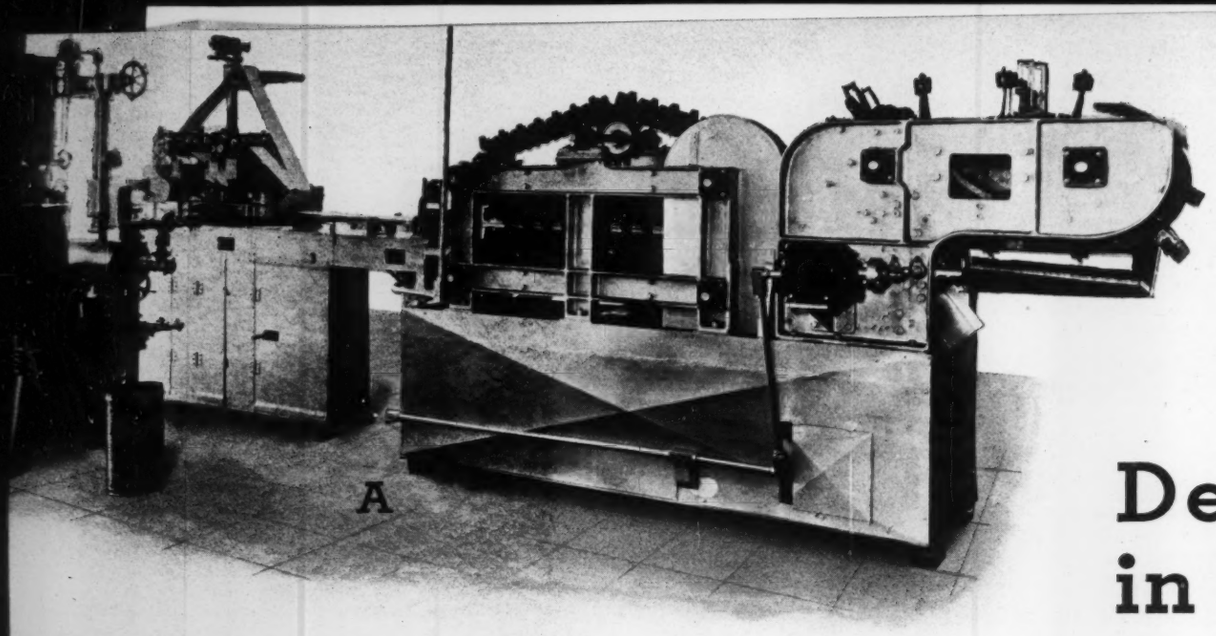
Textile

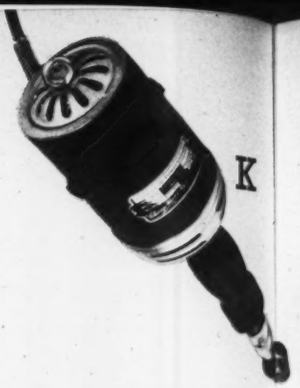
Cotton Looms,
Crompton & Knowles Loom Works,
Worcester, Mass.

Portable Piece-Sewing Machine,
Singer Sewing Machine Co.,
New York.

Sanforizing Tenterett,
H. W. Butterworth & Sons Co.,
Philadelphia.

Short Model Tenter,
Textile Finishing Machine Co.,
Providence, R. I.





Design Feat
in New Mach

A Pictorial Presentation of Recent I
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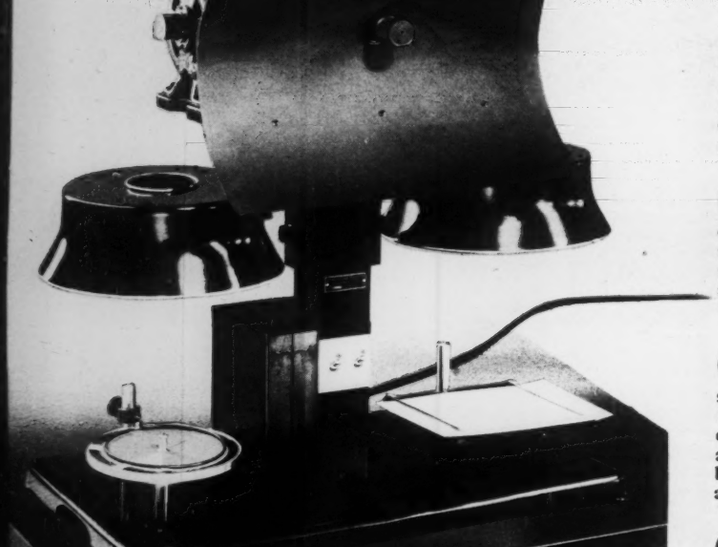

(A) Careful attention to sales conditions has brought about the design of this completely automatic ready-dipped bulk ice cream plant by Vogt Processes Inc. The machine delivers wrapped cylindrical rolls of cream, obviating the possibility of loss through packing by the retailer.

(B) Use of a hollow shaft motor with its scanning prism, and mounting of the motor directly in the optical path so that the light beam passes along its axis of rotation has made possible the design of a color analyzer by Bausch & Lomb which is extremely quiet and which does not require the stopping of the motor to make adjustments.

(C) In case the electrical mechanism should fail to stop the motor on this Baker Perkins high-speed shredder for rayon, an especially designed coupling between it and the gear reducer will slip at a certain overload. The electric equipment for tilting comprises a push button and an automatic reversing switch and limit switch to stop the geared head tilting motor automatically.

(D) Twenty-five adding machines controlled by a single set of keys make up this proof machine for banks built by International Business Machines Corp. In addition to a built-in
an arm rest designed to relieve
is provided with a device which
either direction, automatically
represents the shorter travel.

(E) Complete enclosure of mech
appearance are exemplifi
Electric arc welder for job shop
assured by patented dua'(contr
dependent adjustment of open
welding current.

(F) A pair of stainless steel dis
the chocolate or other mate
is conveyed to the overhead feed
the coating machine of Newcr
Co. around which the other part
of coating is controlled by vol
from a nozzle under which the

(G) Attention to finish h
electrically-operated ribb
Addressograph Co. a more than
the other machines and equip
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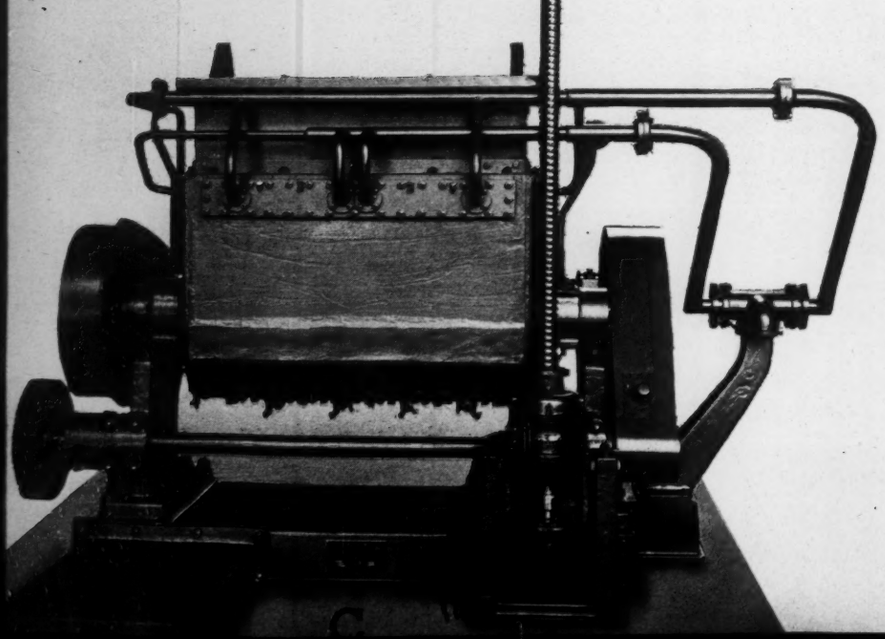

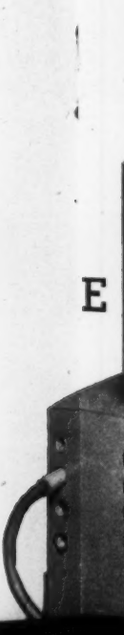

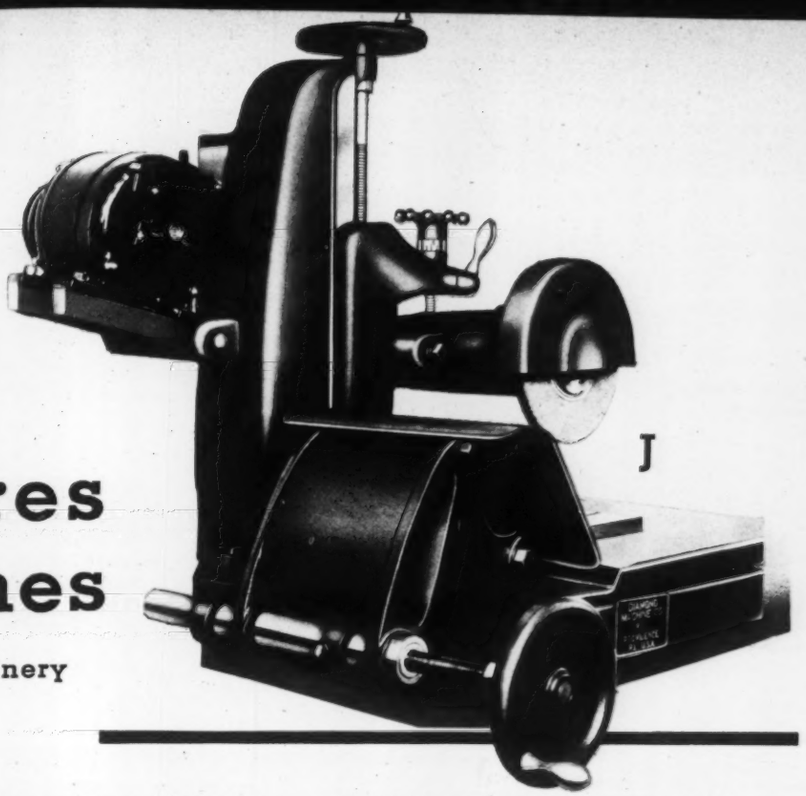

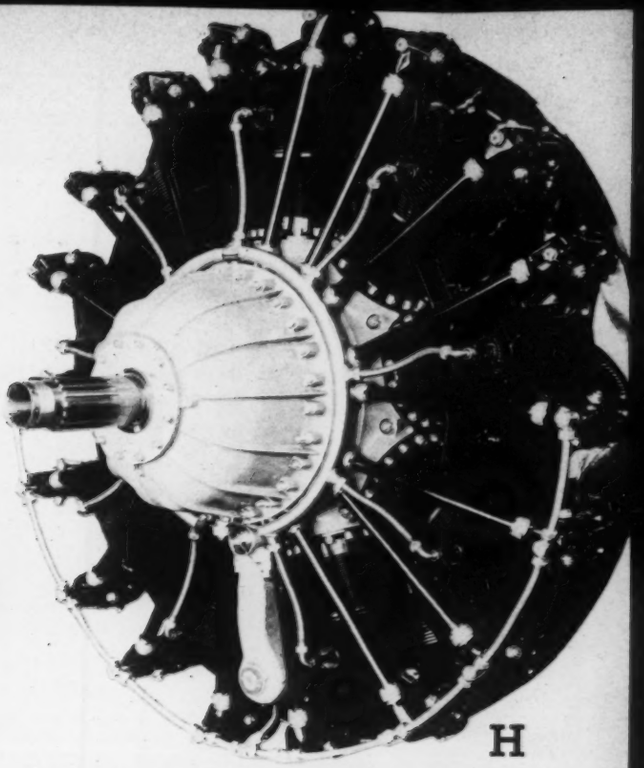

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f Recent Machinery
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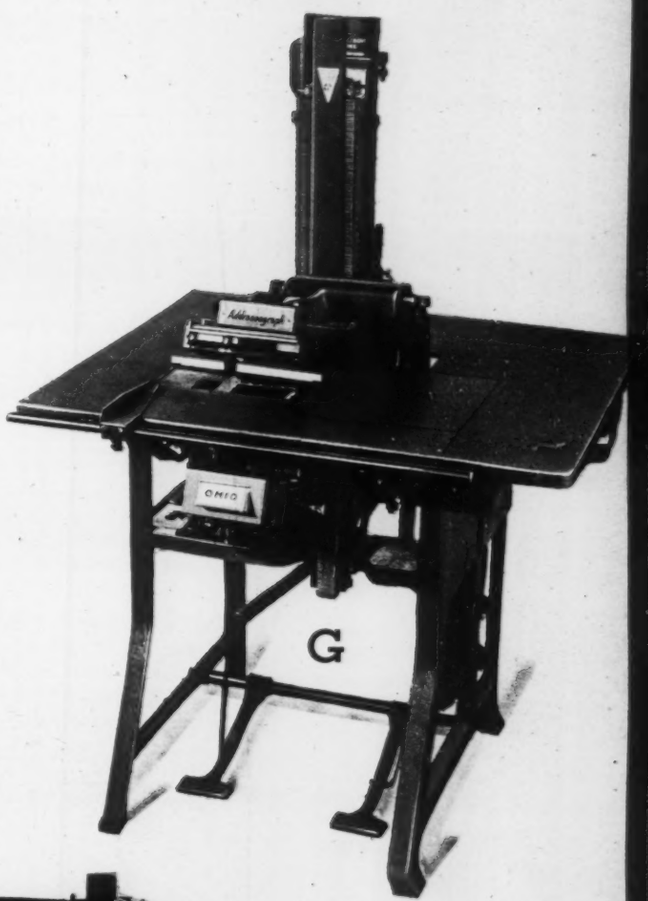
less steel disc conveyors by which
r other material from the reservoir
verhead feed bar are the heart of
e of Newcraft Coating Machine
e other parts are built. Thickness
olled by volume of air delivered
which the product passes.

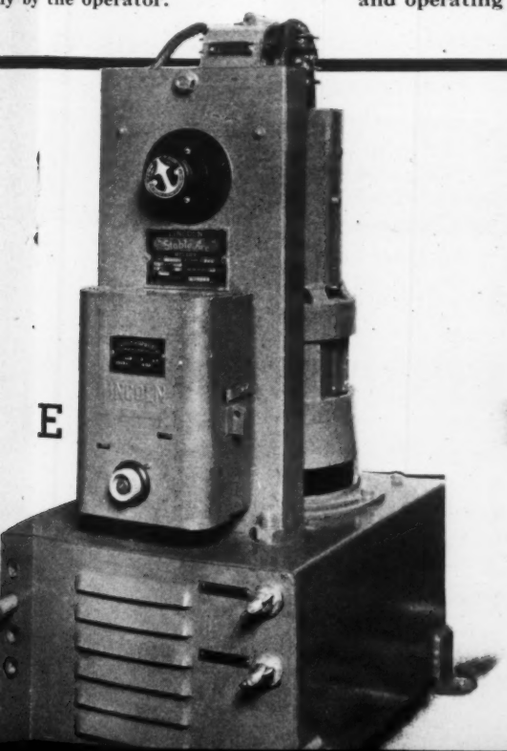
finish has made the new
erated ribbon-print machine of
more than fitting companion for
and equipment with which it
in the office. The machine is
ial attachments for varying work
ly by the operator.

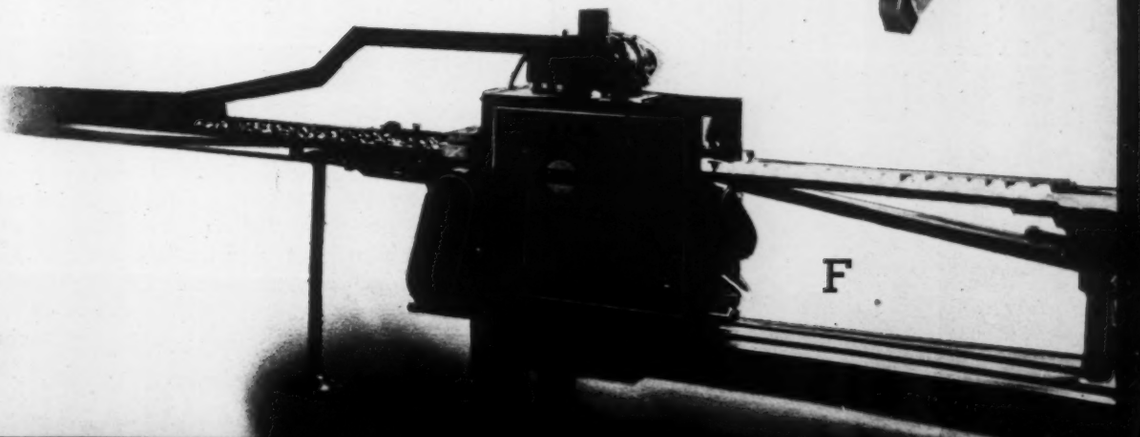
(H) Pressure lubrication is employed for the valve tappets, ball ends of the push rods and rocker bearings on the new Pratt & Whitney Wasp aircraft engine. Pistons are machined from aluminum alloy forgings. A magnesium alloy cast rear section supports all engine accessories and houses the induction system. Supercharger drive has been redesigned to provide anti-friction bearings on both ends of intermediate drive shaft.

(J) Simplification has been advanced in the knee action surface grinding machine of Diamond Machine Co., by the elimination of the intermediate table with its many scraped ways and oil films. The spindle is fitted in a taper plain front bearing with a rear ball and radial thrust bearing. An automatic spring take-up adjusts both bearings. The motor is mounted on rubber so that vibration is not transmitted to the point of grinding.

(K) A viscous type air filter which filters and cleans all air that enters the tool is built into the portable grinder of Chicago Wheel & Mfg. Co. Motor housings of heavy cast aluminum extends out over the motor shaft and air filter and is encased with an insulating cushion grip, giving positive control and operating flexibility.







MACHINE DESIGN

Good Appearance Goes Long Way Toward Reflecting Good Performance

ELSEWHERE throughout this issue reference is made to appearance in machines. Prominence is given in one article to "design" patents. Another contribution deals with appearance from the standpoint of utility. Still another article covers the matter of finishes.

Behind all these references one thing stands supreme—merchandising. Enclosed mechanisms have other advantages such as safety and protection from abrasive dust. But, primarily, designers are becoming more and more conscious of the fact that prospective purchasers are influenced strongly by visual factors. The buyer has found that if a machine looks efficient the probability is that it will prove efficient. If it looks sloppy, it may be cheap, but little can be expected of it in operation.

One need look no further than to the record-breaking streamlined train to find distinct evidence of the combination of appearance and performance. Or to the present-day automobile which also combines speed with beauty of line. The influence of these designs cannot but be reflected in practically all other classes of machinery—in fact, indications of this are increasing daily.

The current trend toward good appearance does not mean that design is becoming elaborate or decorative. Simplicity is the keynote. And that very simplicity is symbolic of good taste, ruggedness, utility and performance.

• • •

Utilize Technical Minds!

HUNDREDS of highly qualified technical men, scientists and engineers have been thrown into comparative idleness through the depression. During this period billions of dollars have been expended in relief work of the laboring type, yet government and other laboratory staffs, upon the successful functioning of which much employment depends, have been increasingly depleted.

One effort to counteract this was made when a project headed by Dr. Karl T. Compton and Arthur D. Flynn was submitted to the administration, sponsoring a national research program. It was turned down on account of "lack of funds!"

It is now time that engineers of all classes went to work collectively in the endeavor to sponsor research and other projects that not only would provide useful work but would result in benefits to community, state and nation in the recovery program— and after? Some attempts to accomplish this already have been made by the engineering societies, but still more intensive effort obviously is essential.

PROFESSIONAL VIEWPOINTS

Machine Design Welcomes Letters Suitable for Publication

Patent Articles Are Valuable

To the Editor:

WE HAVE received the articles on patents requested in our letter of October 9, and appreciate very much the service you have given us. The articles by Mr. Woodling are very timely and should prove valuable to executives and engineers who are called upon to decide questions relative to patents. Study of the articles not only gives a better understanding of the fundamentals of patent law but also should aid in keeping adequate records of inventions and in furnishing patent attorneys with information which they need in prosecuting cases.

—J. R. PARKHILL, research dept.,
Mathews Conveyor Co.

Obtaining Uniform Oscillatory Motion

To the Editor:

ON PAGE 42 of your October issue, there appeared a short article by Mr. C. Ludwig describing a means of obtaining a uniform oscillatory motion using a roller chain construction. The writer is very anxious to obtain more complete information regarding this scheme.

—F. A. ANDERSON, president,
The Burdick Corp.

To the Editor:

IN REGARD to the inquiry on the mechanism for uniform oscillatory motion that was described in the October issue of MACHINE DESIGN, it is my hope that the following additional data on the rig will be of assistance. We used this particular scheme to oscillate a hot metal lander on one of our recent installations. The required stroke in this case was 50 inches and the resistance to the actuating effort was calculated at 800 pounds. The mechanism was originally set for 8 cycles per minute.

The roller chain used was 1-inch pitch and the sprockets were 2½-inch pitch diameter. One sprocket was driven through a suitable speed reducer and the other was allowed to idle upon a shaft fixed in an adjustable take-up to facilitate any changes of the stroke. Simple guides, of roller width (⅝-inch), were mounted so as to provide a resistance for the side thrust created by the off-center effort of the push rod. The roller type chain inherently increased the efficiency of this element of the mechanism.

The push rod was made of a standard structural channel shape. One end of it was fastened to an extended link pin 5/16-inch diameter and a washer and cotter secured this joint. Needless to say, the push rod was secured to the far side of the chain, relative to the shaft bearing, to allow it to pass across the face of the sprocket at the end of each half cycle. The other end of the push rod was secured to the lander support hanger by means of a clevis and pin.

As you can see, this mechanism does not provide for a uniform oscillatory motion throughout the entirety of the stroke as we get a simple harmonic motion at the end of each half cycle. However, this deviation from the uniform occurs over so small a percentage of the full stroke that it can be safely neglected. As a matter of fact, this slight error actually improves the mechanism as it tends to dampen the effect of the impact caused by the reversal of the direction of the oscillating members.

—C. LUDWIG,
Hazelett Metals Inc.

Springs Combat Inertia

To the Editor:

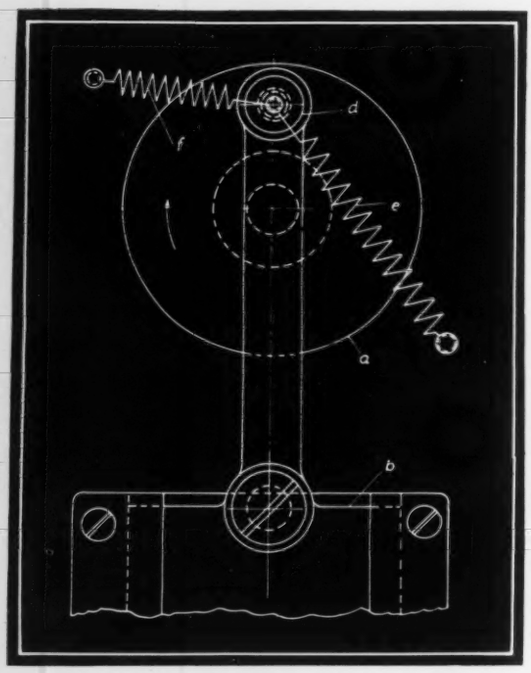
A RATHER ingenious application of coil springs to obviate using a flywheel for assisting a crank pin past its dead center position is shown in the accompanying illustration. Crank disk *a* is rotated continuously in one direction by reciprocating slide *b* through the connecting rod. All members are of conventional design with the exception of crank pin *d* which is extended beyond the connecting rod to provide a post for one end of each of the springs *e* and *f*. The other ends of these springs are attached to the stationary posts.

The slide as shown is at the top of its stroke with crank pin *d* at its dead center position. However, when the slide commences to move downward, the tension in spring *e* being greater than that in spring *f*, the crank pin will be swung toward the right and past the dead center. The slide continues its movement to the bottom of its stroke, at which point the crank pin will be at its lower dead center position.

Now, during this downward stroke, spring *e*

gradually loses its tension and becomes slack, while spring *f* is stretched until it has stored up considerable energy. Consequently, the action is similar to that at the top of the stroke. That is, spring *f* pulls the pin toward the left past the dead center, and the slide, moving upward, continues the rotary motion of the crank disk.

Thus, the alternating contraction and stretching of the coil springs serve to assist the crank pin past both of its dead center positions. The resistance of the springs selected should not be greater than is required since extra power is consumed in stretching the spring. However, it should be pointed out that the pull of one spring is, to some extent, counteracted by that of the other so that the additional power used is not great.



Springs assist in carrying crank past dead center

—John E. Fenno,
Belleville, N. J.

Isn't It True?

To the Editor:

Isn't it true that—
When your office boy makes a mistake—
you charge it to profit and loss.
When your salesman makes a mistake—
a letter usually corrects it.
When your mechanics make mistakes—
you send new parts gratis.
But if your machine designer errs—
Good Night Sales and Business Reputation!

—R. L. Roy,
New York.

Dairy Machines Use More Stainless Steel

DEVELOPMENTS in the dairy and ice cream industries as reflected by the recent Dairy Industries exposition give additional evidence that engineers have continued to design new and better machines despite the condition of general business. Gradual improvement in all of the machines is general, while many new models have been developed to accommodate new processes or new products, or to introduce automaticity to fields where hand operation has long been the rule.

The introduction of automatic machines was more prevalent in the ice cream division of this year's show than in the strictly dairy division. This latter group has for years past tended to complete automaticity in order to enhance as much as possible the necessary cleanliness in addition to the speeding up of production and reduction of labor costs.

In the ice cream field several of the machines were designed to overcome a human factor that has worked to the economic disadvantage of ice cream manufacturers. As ice cream when placed in the can includes a large proportion of air, it is obvious that a little accidental packing down by the dispenser will soon reduce the amount to be paid for by the purchaser. The maintenance of the original volume will bring in additional revenue and allow the retailer to pay a higher price for the product. To attain this desirable condition, Vogt Process Inc. has developed a small plant for making ready-dipped bulk ice cream (see page 38) by the use of which the retailer merely dispenses packages and thus sells the same quantity that he buys.

Aluminum Paint Employed

A noticeable trend in the exposition was the wide-spread use of aluminum paint on the parts of the machines not fabricated from stainless metals. Manufacturers and dairymen express the opinion that the aluminum paint provides the necessary appearance of cleanliness that will encourage operators to keep their machines absolutely clean, and enhances the appearance of the plant, a most important factor in this industry.

Materials are, of course, of especial interest in the dairy field. All of the machines exhibited made extensive use of stainless steels of varying compositions. In fact, several of the units are little more than stainless steel tanks or enclosures with only a minimum of simple mechanisms employed. The reason for this intensive attention to materials selection is that every dairy machine must be as sanitary as it is humanly possible to make it.

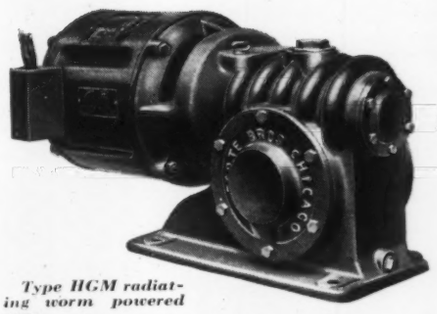
Choose an

IXL
THE MARK OF QUALITY

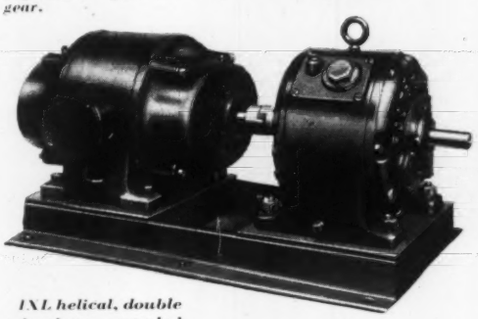
Powered Gear

for

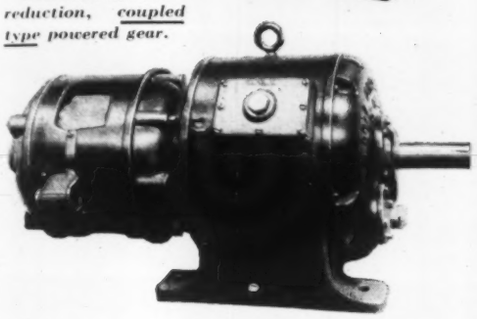
Every Slow Speed Drive



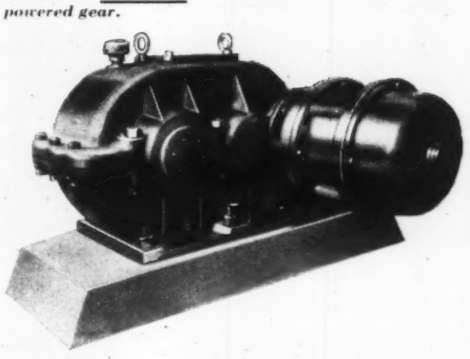
Type HGM radiating worm powered gear.



IXL helical, double reduction, coupled type powered gear.



IXL Helical double reduction unit type powered gear.



This IXL heavy duty industrial or oil well powered gear was developed for applications where heavy shocks and load reversals require exceptionally rugged design and construction.

Heavy duty, combination worm and helical powered gear for vertical agitator drive.

Vertical, double and triple reduction, unit type powered gear. Positive leak-proof design. Ideal for mixers, agitators, etc.

SCORES of problems in the application of slow speed power can be solved by each of the many types of IXL powered gears.

There's 75 years experience in designing and manufacturing gears and speed reducers back of these units. There's a Foote Brothers sales engineer ready to put this experience at your disposal in the selection of the exact type needed for your job.

There is also a complete and varied line of IXL Spur, Helical, Herringbone and Worm Gear Speed Reducers if the Powered Gear isn't just the right answer.

Write or phone for our nearest representative to call or mail the coupon for your copy of "Gear Problems."

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GEAR AND MACHINE CO.
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Special Machinery
Gears of all kinds
Flexible Couplings
Friction Clutches
Speed Reducers
Powered Gears

(For Executives and Engineers)

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Please send me, without obligation, copy of the 64-page designing engineer's text book, "Gear Problems."

Name.....

Company.....

Address.....

MEN OF MACHINES

HONOR was bestowed upon John Cromwell Lincoln recently by the American Welding society. He was awarded the Samuel Wylie Miller medal in recognition of his contributions to the advancement of electric fusion welding.

The recipient, who is chairman of the board of Lincoln Electric Co., was one of the early pioneers of arc welding. He was born in Painesville, O., July 17, 1866, and is a graduate of Ohio State university in electrical engineering.

In 1888 he joined the staff of Charles F. Brush, inventor of the arc light. Later Mr. Lincoln became affiliated with the Elliott-Lincoln Co. and in 1896 with this company as a nucleus, formed his present organization.

JOHN C. LINCOLN

• • •

RETIREMENT of Henry M. Chase from the engineering staff of the Worthington Pump & Machinery Corp. brings to attention the impressive record of a man who has contributed much to his profession. He became affiliated with the organization, then the Deane Steam Pump Co., on June 17, 1891.

With the exception of one year he was continuously identified with Worthington, first as detail draftsman, then as designer, research engineer, chief draftsman, chief engineer and consulting engineer. Mr. Chase was a strong factor in forwarding design and performance of power pumps and in refining the Deane single direct-acting pump steam valve gear.

He is a native of Holyoke, Mass., and was graduated from Massachusetts Institute of Technology in the class of 1891.

HENRY M. CHASE

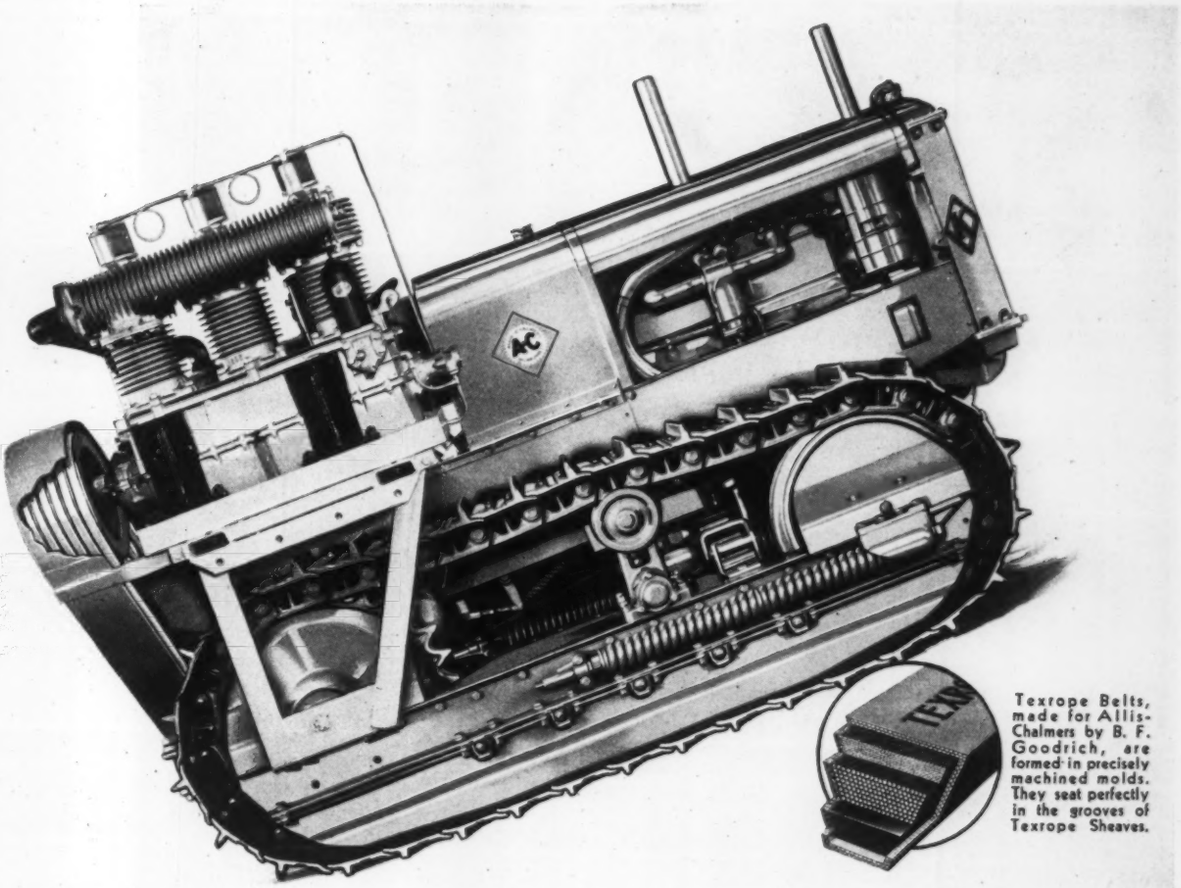
• • •

BY HIS thorough understanding of automotive problems Austin M. Wolf has established an enviable reputation as an authority in his field. He has contributed many valuable articles to MACHINE DESIGN and other journals. He also is active in the Society of Automotive Engineers, on the council of which he recently was nominated to serve.

Born on Dec. 20, 1890, Mr. Wolf has held a number of positions including that of chief draftsman, designing engineer and chief engineer with companies such as Twombly Car Corp., General Vehicle Co., American Motors Corp., Arthur Rehberger & Son, and others.

From 1928 to the present Mr. Wolf has been automotive consultant to firms and individuals in the industry. He commands

AUSTIN M. WOLF



Texrope Belts, made for Allis-Chalmers by B. F. Goodrich, are formed in precisely machined molds. They seat perfectly in the grooves of Texrope Sheaves.

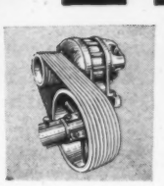
They stand the "gaff"...

TEXROPE Multiple V-belt Drives are invading the toughest fields . . . and promptly delivering the goods. Their successful use on Allis-Chalmers Track-type tractors is but one instance of this. Here is a job that is a job. Because they must travel up hill and down hill, on dry land and marshy land, and across holes and over bumps, these Track-type tractors are subjected continually to severe strains. Yet Texrope Drives are doing all these tractors ask of them . . . and without a whimper. Texrope Drives are economical . . . shock-absorbent . . . silent. No oil, grease, or belt dressing is needed. Tests at Carnegie Institute have shown they are 98.9 per cent efficient.

ALLIS-CHALMERS MFG. CO. MILWAUKEE, WISCONSIN

TEXROPE DRIVES

ORIGINATED BY ALLIS-CHALMERS



high honor among his friends and associates.

* * *

B. F. SHEPHERD, manager rock drill division, Ingersoll Rand Co., is the new president of the American Society for Metals.

* * *

W. D. COLLINS, former chief engineer of the Servel electric refrigerator division of Servel Inc., has been named superintendent of all departments of the refrigerator cabinet division.

* * *

WALTER H. BURR, superintendent of the electrical and mechanical departments of Lukens Steel Co., Coatesville, Pa., recently was elected president of the Association of Iron and Steel Electrical Engineers for the year 1934-35.

* * *

R. W. DAYTON recently was appointed assistant metallurgist at Battelle Memorial Institute of Industrial and Scientific Research, Columbus, O. R. S. PEOPLES has joined the staff.

* * *

DANIEL B. WORTH, chief engineer of Whitcomb Locomotive Co., Rochelle, Ill., has joined the engineering department of Baldwin Locomotive Works, Philadelphia. He will be identified with the engineering of Baldwin and Whitcomb electric and internal combustion locomotives.

* * *

OTTO NONNENBRUCH has been transferred to the New York office of the De La Vergne Engine Co. He was at one time engaged at Blohm and Voss Shipyard, Hamburg, Germany, in the development of double acting two-cycle marine diesel engines.

* * *

RUDOLPH M. KANIK has become associated with the engineering staff of A. O. Smith Corp., Milwaukee, to engage in general development work. He formerly was president and general manager of Moloch Foundry & Machine Co. Kaukauna, Wis.

* * *

DR. HERMAN VON SCHENK, consulting timber engineer, St. Louis, was elected president of the American Society for Testing Materials recently to fill the vacancy caused by the death of W. H. BASSETT.

* * *

ARNOLD LENZ was awarded the J. H. Whiting gold medal of the American Foundrymen's association. He is assistant manufacturing manager in charge of the Flint, Bay City and Saginaw plants of the Chevrolet Motor Co.

* * *

DR. C. B. JOLLIFFE has been named chief engineer, and E. J. JETT, A. D. RING and W. G. H. FINCH, assistant chief engineers, of the Federal Communications commission.

* * *

WILLIAM B. STOUT is the presidential nominee of the Society of Automotive Engineers for the year 1935. As recorded in his biographical sketch (M. D., Sept. 1931) he is one of the most versatile of designing engineers and executives in the automotive and aircraft industries. Nine vice presidents, one representing each professional activity of the S.A.E., also were nominated.

* * *

JOHN CHIPMAN was the recipient of the Henry Marion Howe Hall medal of the American Society for Metals at the recent National Metal congress. He is research engineer University of Michigan.

* * *

H. H. LEONARD was re-elected president of Packaging Machinery Manufacturers institute at the recent second annual meeting in Chicago.

* * *

D. C. SELHEIMER, who joined the engineering department at the Racine, Wis., plant of Massey-Harris Co. in 1929, recently was appointed general manager.

* * *

W. KING WHITE, Cleveland Tractor Co., Cleveland, was elected president of the Farm Equipment institute at its recent convention in Chicago.

Obituaries

DEATH last month brought to a close the career of DR. CALVIN W. RICE, who for 28 years served as secretary of the American Society of Mechanical Engineers. MACHINE DESIGN (Jan., 1932) on the occasion of his election to honorary membership in the society, presented his biographical sketch. He was born at Winchester, Mass., Nov. 4, 1868. After attending public schools in Boston, New Haven and Winchester, he spent four years at Massachusetts Institute of Technology from which he was graduated in 1890 with an A. B. degree in electrical engineering. Dr. Rice then held successively numerous positions from which he obtained a wide experience in electrical, hydraulic and steam engineering, combined with managerial and executive work. His professional activities included considerable research conducted for General Electric. His ability to build organizations is reflected in the success of the A.S.M.E. of which he had been secretary since 1906. Even before that year, however, he performed noteworthy service to engineering organizations in America.

* * *

WILLIAM BARBER, reputed to be one of the first makers of disk wheels for automobiles and the inventor of many improvements on motor cars, died recently. One of his most important inventions was the overhead valve mechanism of the gasoline motor. He also designed the first practical motorcycle engine used in this country.

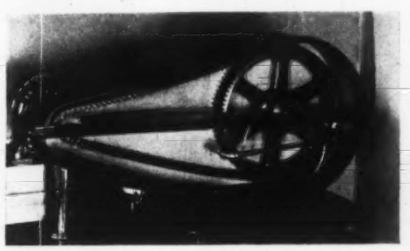
ADVERTISEMENT—*Each item on this page is a paid advertisement*

POWER TRANSMISSION NEWS

A recent order for drives for a stern-wheel river boat led to an investigation into the performance of two 115 h.p. drives installed on the river towboat *Tennessee*, in 1929. Power plant and transmission are a Diesel engine coupled to a D.C. generator, driving two 115 h.p. motors.

Both motors drive the stern wheel through two Morse Silent Chain Drives, each 12 inches wide, on 19 and 107 tooth sprockets and eight feet long between centers. Normal full load motor speed is 575 r.p.m.

The boat is now operated by the War Department, and government engineers report on this 5-year-old installation: "No troubles have been experienced. The towboat has traveled approximately 14,000 miles. . . . "and . . . if we were to design additional towboats of this type, I have no doubt that drives similar to those used on the *Tennessee* would be employed."

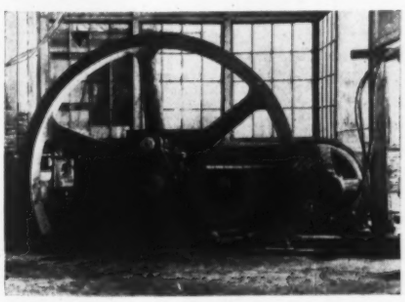


The above picture shows an exhibition drive equipped with Morse Ring Oiler, the case has a glass front.

The Morse Ring Oiler provides a continuous flow of oil upon the chain while operating. Morse chains oiled by this simple device will operate at highest efficiency and require little attention. The oil is carried from a reservoir in the bottom of the case, trapped in a cup, led through the pipe and allowed to drip on the chain, the motion of the chain splashes the oil stream sufficiently to uniformly lubricate the entire width of the chain.

Morse Speeds Up Power Change-Over

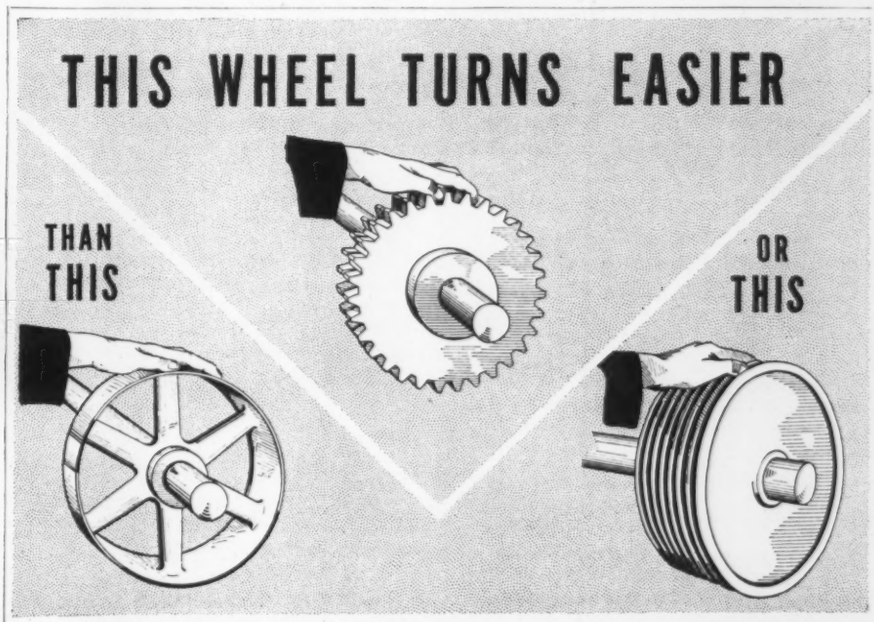
Recently a rubber mill in changing over from steam to electric power was faced with the problem of placing the transformers in the engine room, and the switchboard in the space occupied by the cylinder of the Corliss engine which was coupled to the main line shaft. Since the main line shaft had to be driven until the



power could be turned on, the situation was quite complicated.

One hundred fifty h.p. was needed by the mills on this shaft. A Morse engineer found that the only space available for a chain drive sprocket on the engine shaft was that occupied by the eccentrics. This temporary installation was going to be used for only about six months, and with the large overload capacity in a chain drive, a chain which normally would have been rated at about 100 h.p. could be safely used for this short period. This chain, 10″ wide, just cleared the flywheel and the bearing stand. A motor was rented and mounted on a suitable foundation. At noon, one Saturday, the connecting rod and eccentrics were removed, a keyway cut in the shaft, and the split chain sprocket was put in place. The Morse Silent Chain was put on and the plant was ready for operation before Monday morning.

During the time necessary to complete the electric installation, the temporary motor carried the shop along, the only attention required being an occasional application of grease on the chain. The new electric drive included two 75 h.p. motors for mills and a 50 h.p. and 75 h.p. for two calenders, all with Morse Chain Drives. A 200 h.p. direct-connected, slow-speed, synchronous motor is used on another mill line shaft. When it becomes necessary to replace one of the other chains, the temporary chain can be re-assembled into the proper width and used.



TEETH—NOT TENSION
TURN
CHAIN DRIVE SHAFTS

Study the above illustration. You'll immediately see why chain drives are positive. They just can't slip. Bearing load is reduced. Chain drives deliver power with an average of 98.6% efficiency.

This high efficiency coupled with long life, low first cost, ease of installation and reduced maintenance costs means savings in production.

Ask for more information

MORSE CHAIN COMPANY

A Division of Borg-Warner Corporation
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TOPICS

FREQUENTLY the question of the number of engineers in the country arises. It will interest those who must provide the answer that one of every 210 persons employed is an engineer. Based on 1930 census reports the 225,787 engineers employed constitutes 0.48 per cent of total employment in the United States, according to the American Engineering council, Washington. A breakdown of engineers, by classes, shows the following result: 101,946 civil engineers, or 45.12 per cent; 57,735 electrical engineers, or 25.56 per cent; 54,264 mechanical engineers, or 24.03 per cent; 8,408 mining engineers, or 3.75 per cent; 3,434 chemical and metallurgical engineers, or 1.54 per cent.

* * *

Aeronautical technology may soon have an opportunity to prove itself in another field—transoceanic air transportation. Heavier-than-air and lighter-than-air proponents have gathered in Washington to lay their respective cases before the government, in an effort to obtain its support for commercial airline routes across the water. Dr. Hugo Eckener is here to show what the Graf Zeppelin has accomplished by way of its South American service. He believes that with four airships, two built in this country and two in Germany, a practical self-supporting air service between great trading centers in the United States and Europe can be established.

* * *

Papers presented at the recent meeting of the American Gear Manufacturers' association in Milwaukee dealt principally with gear design, production and use. Discussing the relative merits of single helical gears, double helical gears of the hobbed type and of the continuous tooth type, P. C. Day, Falk Corp., declared that no one design can be said to be superior to both of the others for all installations. Single helical gears have advanced in prominence recently due, for the most part, to the commercial expansion of the thrust resisting type of roller bearing, but in driving from one parallel shaft to another it is scarcely logical to introduce a thrust condition merely because it can be offset by a bearing, he pointed out.

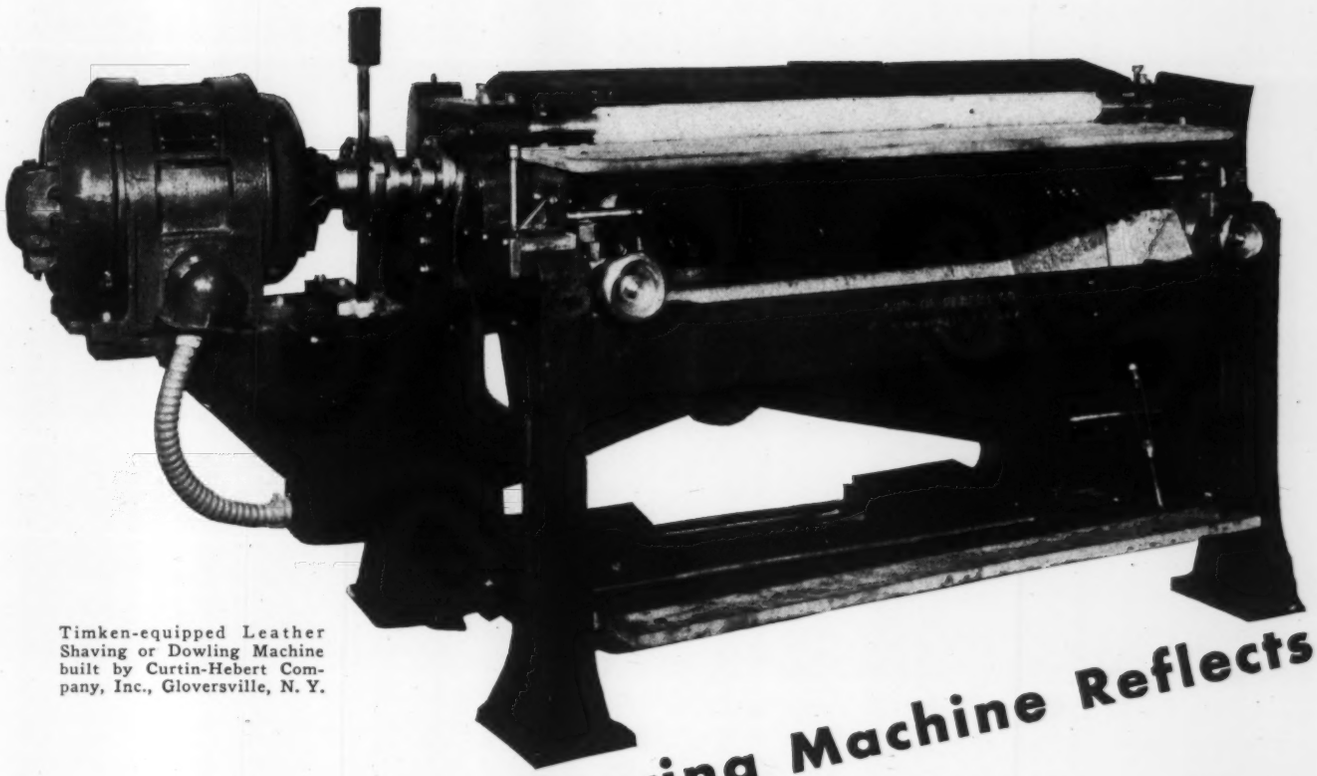
W. E. Sykes, Farrel-Birmingham Co. Inc., Buffalo, presented a paper on "Advantages of Sykes Herringbone Gears," and Thomas Holloway, United Engineering & Foundry Co., Pittsburgh, discussed "Welded Steel Construction." Business transacted at the meeting included the adoption of a recommended practice for rating helical and herringbone speed reducers.

* * *

Quite in contrast to the situation that prevailed not so many months ago is the present urgent need for more technical engineers in trade and industry. This condition was revealed by a recent survey conducted by the American Engineering council. In this study the extremely low percentage of engineering employes in most of the groups shows that technological efficiency only has begun throughout most of our economic system. Singularly enough it was found that agriculture is at the bottom of the list with only 1/100 per cent of its workers engineers. Even the building and mining industries which are becoming more extensively mechanized are in the magnitude of only 6/10 per cent.

* * *

Points made by E. S. Chapman of Chrysler's Amplex division in his recent S.A.E. paper on surface broaching serve as a fitting supplement to the several references to the subject in past issues of MACHINE DESIGN. After presenting what might be called case studies he made this observation: "While we have experienced the usual troubles incident to getting new setups into full production, the average broaching machine is a much simpler, more rugged and trouble-free mechanism than the average milling machine and in general, is less costly in original investment, in maintenance of machine, cutting tools, in floor space and man power. One of the inherent advantages of broaching is that separate roughing and finishing operations so

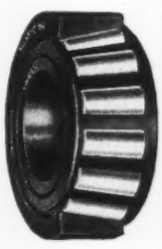


Timken-equipped Leather Shaving or Dowling Machine built by Curtin-Hebert Company, Inc., Gloversville, N. Y.

Unique Leather Shaving Machine Reflects TIMKEN BEARING Precision

IMAGINE a machine so accurate that it can take the printing off an ordinary newspaper—and do it so uniformly that no variation in the thickness of the paper can be detected. That means a reduction of .0015"

This machine is used by glove manufacturers to secure the correct thickness of leather for different kinds of gloves—either men's or ladies'—depending on the type and intended uses. Naturally extreme accuracy is required, since even a very slight variation in the thickness of the skins would affect the fit and appearance of the finished gloves. This is particularly important in the case of fine dress gloves. To obtain and preserve this extremely close operating precision the machine manufacturer mounts the 13" x 50" abrasive roll on Timken Tapered Roller Bearings—two bearings at each end of the roll. Timkens eliminate friction and wear; hold the roll in correct and constant alignment; and protect it against radial, thrust and combined loads.



In this as in thousands of other bearing applications throughout all industry, there is no substitute for the exclusive combination of Timken tapered construction, Timken positively aligned rolls and Timken Alloy Steel.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

common in milling practice are not required, which in itself saves half the total machine cost for the surface under consideration."

* * *

Recently announcement was made of a process for the manufacture of aluminum, which is claimed will make America independent of obtaining that product from foreign countries and will appreciably increase its use in the automobile and other industries. The discovery was made public by Charles B. Bohn, president, Bohn Aluminum & Brass Corp., Detroit. He declares that the process, which involves the use of alunite ore, results in a purer product than present manufacturing conditions allow. A $50,000 plant will be constructed immediately to perfect production operations, he asserted. The expansion program to handle large scale manufacturing of the new product will involve the erection of a sheet and wire mill.

* * *

According to Col. Leonard P. Ayres, resumption of activity in the textile industry may mark the termination of the most recent business recession. He declares that the controlling factor in unemployment among producers is that of the workers in the durable goods industries. There is the key to our depression problem, he says. The solution depends largely on restoring business confidence and reviving long-term credit.

* * *

An announcement comes from the American Society of Mechanical Engineers that a *Journal of Applied Mechanics* will be published in four quarterly issues next year. It will contain papers on applied mechanics which have been presented before that division of the society, as well as other papers, reviews of pertinent literature and notes on important developments. The journal will be sold to non-members at $5 per annum.

* * *

Automotive engineers are looking forward to the celebration in 1935 of the thirtieth year of activity of the Society of Automotive Engineers. One of the events included in the preparations will be the annual meeting in Detroit Jan. 14-18 which will be extended through five days instead of the usual four. The thirtieth anniversary dinner will be held at Hotel Commodore in New York Jan. 7, the week of the automobile show.

* * *

In a recent dispatch in the *New York Times* regarding new students entering Cornell university it was pointed out that the changed attitude toward engineering as a profession which has been apparent in the past few years has resulted in a shifting of the emphasis on the part of a number of students from the regular engineering courses to a new course in administrative engineering which was started there three years ago. More and more entering students are choosing the latter course which combines a broad business training with an engineering background.

* * *

Attention is being turned to new models in the automobile world. In this connection it is interesting to note, according to *Steel's* Mirrors of Motordom, that the curvature of the front of the airflow DeSoto will be more abrupt, thereby lengthening the top horizontal section of the hood. This is being done to overcome the objection to stubbiness of present models.

Reports coming to Chrysler engineers indicate that one of the good points of the airflow design is the accessibility of the engine. One lifts up the hood toward the cowl instead of from the side as in other cars and finds all parts that generally need slight adjustment in plain view.

* * *

Expressing current sentiment, John W. O'Leary, president of the Machinery and Allied Products institute, recently declared in Chicago that a definite commitment by the federal government that it has no intention of making any further inroads into the field of private business would undoubtedly see a sharp upbound in economic recovery. In our own particular field of activity, he said, there is no doubt that fear of government competition and uncertainty of what Washington's next move will be, have seriously retarded improvement. There is no denying that many of the measures incorporated in recent laws have been commendable but, as is always the case in a program of sweeping changes, the pendulum can sweep just too far the other way.

* * *

New fields are being opened for the application of rare metals, according to Dr. J. W. Marden, assistant director of research of the Westinghouse Lamp Co. Addressing the recent annual meeting of the Electro-chemical society he revealed that rare metals, having healing and curing properties, will add many years to human and animal life, as well as improve and increase the nutrition in food products and eventually control production of crops. These rare metals, Uranium and Thorium, scarcely known outside of the research laboratory, now are used in photoelectric cells, glow tubes and X-ray targets.

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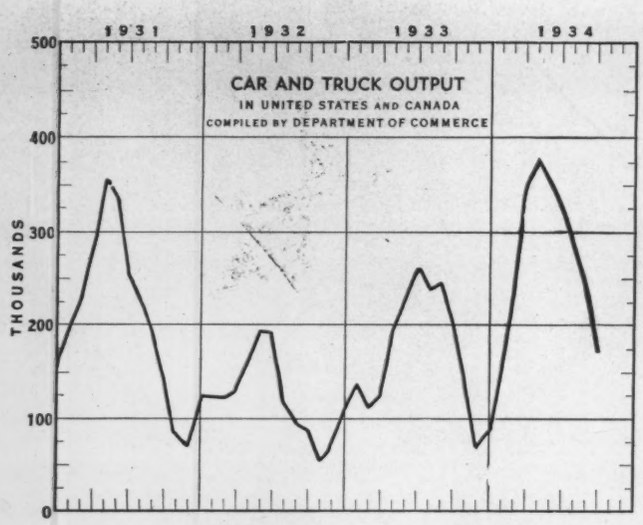
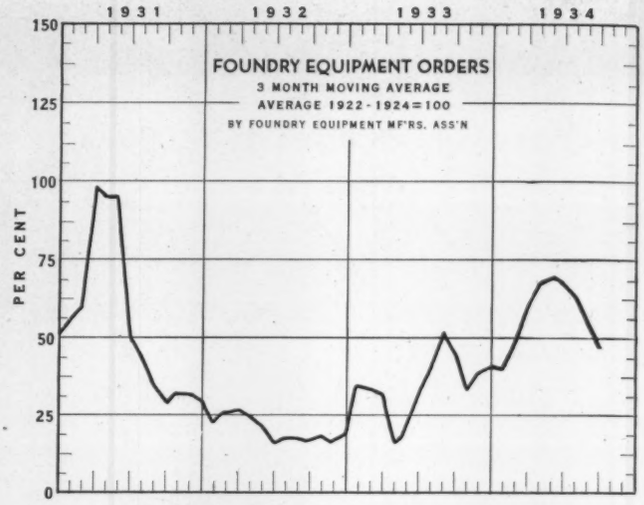
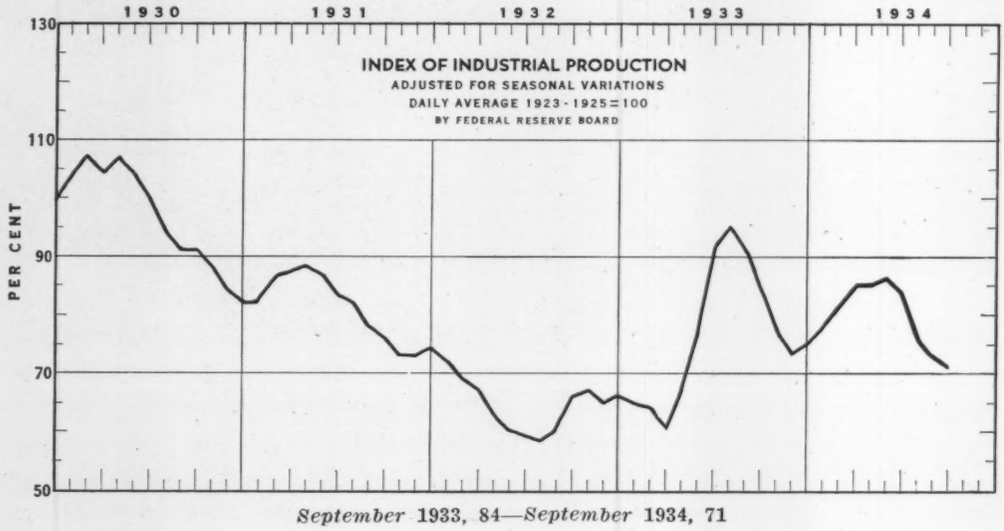
How Is Business?



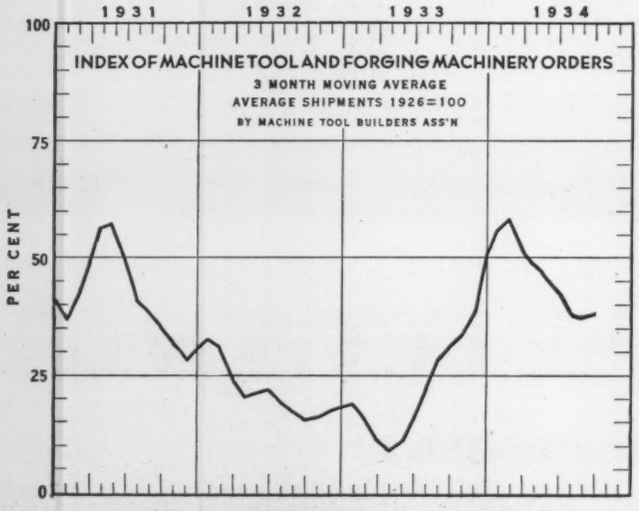
September 1933, 197,608—*September* 1934, 174,451



September 1933, 46.7—*September* 1934, 46.7



September 1933, 84—*September* 1934, 71



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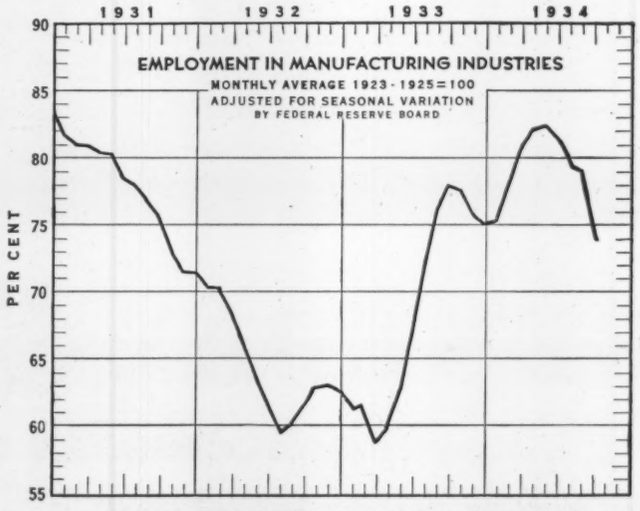
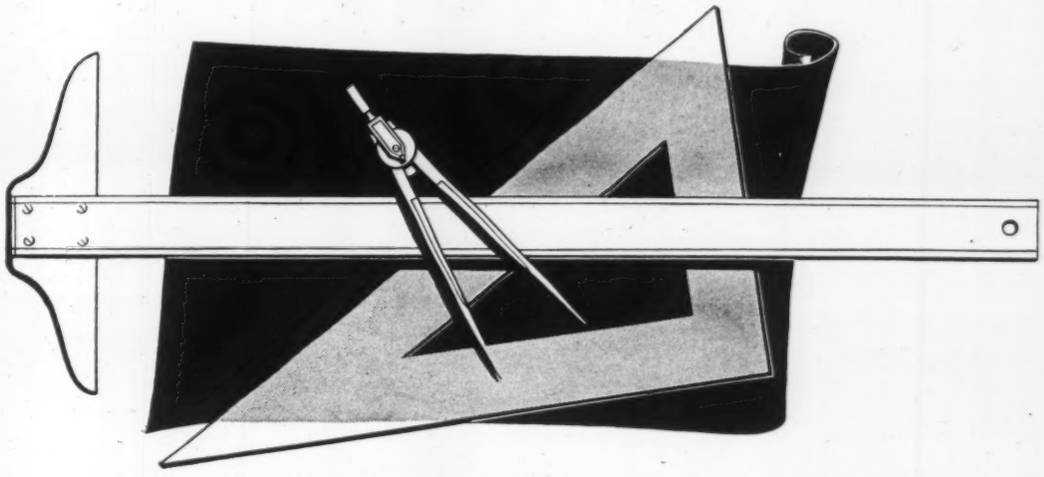


September 1933, 78.0—*September* 1934, 73.9



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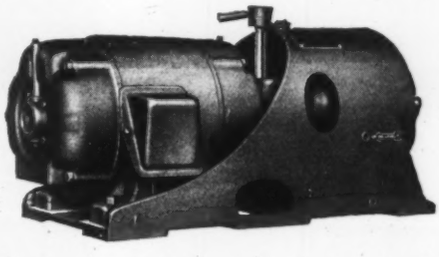


Illustrating application of Century four-speed Splash Proof Motor to two-speed gear.

Century MOTORS

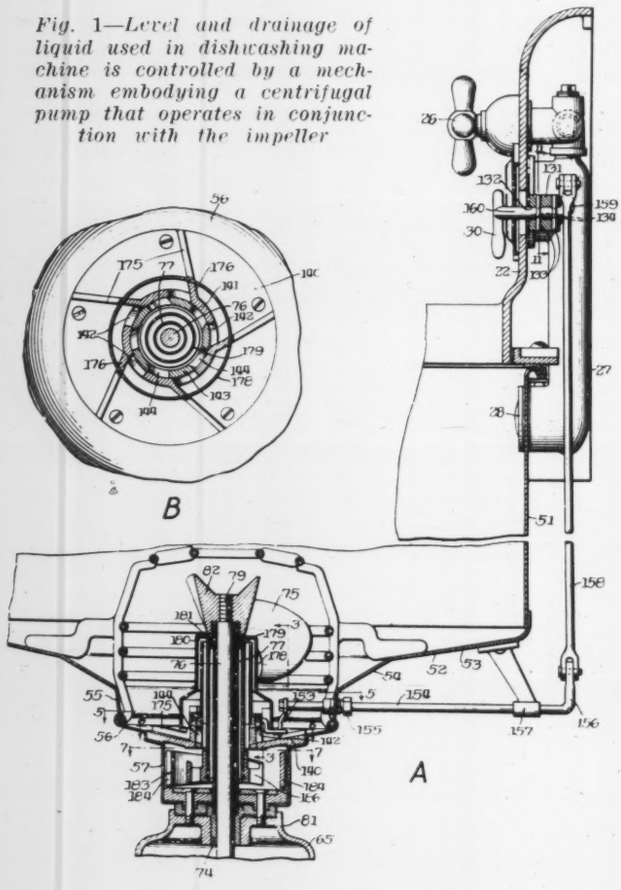
NOTEWORTHY PATENTS

PARTICULARLY in view of the keen interest in dishwashing machines, attention this month is directed to a unit patented by E. S. Stoddard for the Conover Co., Chicago. Improved liquid level control and drain mechanisms are features of unique design.

Racks (not shown) containing the objects to be washed are placed in the washing chamber of the machine above impeller 75, *Fig.* 1 *A*. Valves then are opened so as to admit liquid to the washing chamber outlet 28. It is preferable to start impeller motor 65 before admitting the liquid. In this way the starting torque of the motor is of course reduced, and moreover a centrifugal pump 183 in chamber 57 is actuated so as to discharge any overflow or excess cleansing or rinse liquid. This is because when the tank has been filled to the height of tube 179 it will overflow into chamber 57 and discharge through a line into the sink. When it is desired to drain the tank completely, handle 30 is turned so as to place openings 142 *B* in co-operation with opening 144 to permit all liquid in the lower part of the tank to drain into the pump or discharge chamber 57.

Blades 184, (*A*) are curved outwardly in an opposite direction to the direction of rotation so as to give maximum centrifugal effect on the water being discharged. Excess water flows upwardly between shield 178 and a tube, then downwardly between the tube and impeller tube 179. Number of the patent is 1,976,902.

Fig. 1—*Level and drainage of liquid used in dishwashing machine is controlled by a mechanism embodying a centrifugal pump that operates in conjunction with the impeller*



A RECENTLY patented invention relates to sheet control mechanism for printing machines, with the object of providing a device that

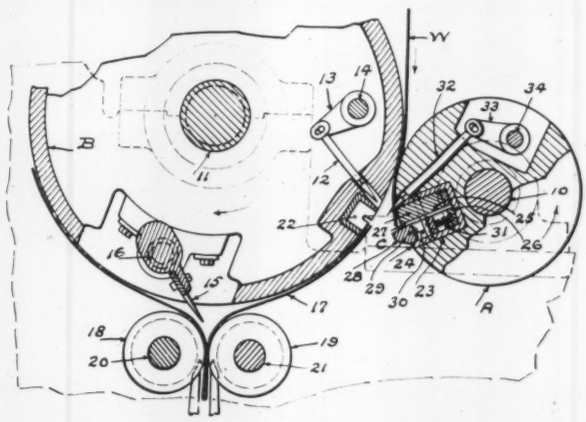


Fig. 2.—*Sheet control mechanism prevents premature displacement of sheet from cutting cylinder*

will prevent premature displacement of the sheet from the cutting cylinder until it has been carried around the periphery of the latter for the purpose of placing together with the sheet carried by the folding cylinder. *A* and *B*, *Fig.* 2, designate the cutting and folding cylinders respectively. Folding cylinder *B* is provided with one or more sheet or web-taking pins 12 fastened on arms 13, and connected to rocking shafts 14. A folding or tucking blade 15, fastened to shaft 16, engages the sheet or collected sheets 17 positioned on the lower portion of cylinder *B*, and thrusts or tucks the sheets into the bite or nip of the folding off rollers 18 and 19. Cutting block 22 is secured to cylinder *B* to operate in connection with the cutting knife 25 of cylinder *A*.

Cutting cylinder *A* is designed with recess 23

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The motor-driven equipment you manufacture is made to stand "tough going". But how about the motor that drives it? Will water, vapor oil, dust, dirt get at the motor and eventually cause motor failure?

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MOTORS

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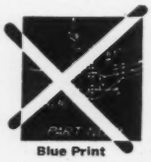

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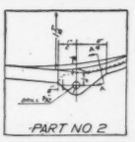

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DRAFTING ROOM EQUIPMENT . . . DRAWING MATERIAL

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in which knife box assembly *C* is positioned. A sheet-taking or engaging pin 32 is connected to arm 33 and is provided for engagement and disengagement with web *W*. By reason of the flush position of the lagging checkblock 27 in cutting cylinder *A*, the portion of web *W* maintained immediately thereover by adjacent pin 32, is prevented from being thrust away from engagement with pin 32 or displaced from the surface of rotating cylinder *A* which now will carry it completely around its periphery until cut by knife 25 to form the lowermost of the sheets shown at the lower portion of folding cylinder *B*.

In operation, further rotation of the cutting and folding cylinders *A* and *B* will convey the cut sheet and web *W* together one above the other, to the position shown where the web has been cut to form the uppermost sheet. Reciprocation of the pins in the folding and cutting cylinders is timed to engage and release the web and sheets at the proper intervals. Number of the patent is 1,969,480, with R. Hoe & Co. Inc., New York, assignee. Clifford L. Shipley, Chicago, is the inventor.

BY INSERTING an adjustable section in the face of a cam to raise or lower the lift, Kenneth Howie has provided a unique machine element. His recent patent covering the feature is

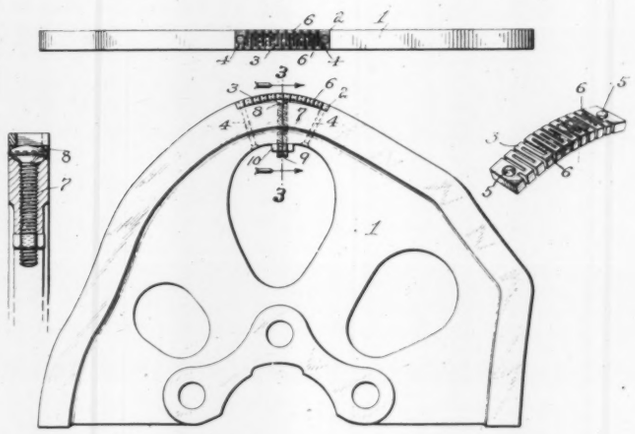

Fig. 3—An adjustable section in the face of cam can be raised or lowered to regulate the lift

assigned to Wildman Mfg. Co., Norristown, Pa. In designing for this adjustment one of the principal objects of the improvement is the maintenance of the flush joint between the ends of the insert, *Fig.* 3, and the adjacent parts of the main body of the cam so that an uninterrupted cam surface will be provided along the periphery. To attain this the insert member is provided with incisions or kerfs 6 which extend alternately from opposite edges. For adjusting the insert up or down a screw 7 is mounted in the main body of the cam, this screw having a head 8

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NICKEL ALLOY STEELS
for Bars, Shafting, Simple Forgings, etc.
This is a general guide and refers only to simple shapes. Steel makers should be consulted regarding irregular sections. The properties recorded are approximate, but representative of those procurable half way between the center and surface. They can be secured in several nickel alloy steels, but only one is given in each case due to space limitations.
Properties given should not be used as minimum specification values, and are not intended to apply to castings.
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HEAT TREATMENT
1500 O QUENCH, °F.
800/900 TEMPER, °F.
A = air
W = water
O = oil
% ELONGATION in 2" 15
% REDUCTION of AREA 44
177 TENS. STR., 1000 lbs/sq. in.
355 BRINELL HARDNESS
TO OPERATE CHART
Select in the margin, (1) the required size and (2) the desired yield point; or, if these are not shown, the next largest size and next highest yield point. When the arrow points to this size and yield point the recommended steel, treatment and approximate properties will be found in the windows above. Chemical compositions of the steels referred to are listed on the back of this chart.
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YIELD POINT LBS./SQ.IN.
DIAMETER
1 INCH
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4 INCH
6 OR 8
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75,000
100,000
125,000
150,000
175,000

ENGINEERS, and all those concerned with materials of construction, will find this chart convenient. It indicates at a glance the steel compositions and treatments which will develop a broad range of properties in simple shapes up to 12" in diameter or equivalent sections. Chemical compositions of the steels referred to are listed on the back of the chart. A dependable general guide, saving time and trouble when you want facts quickly. Send for it today. Use the coupon at right.

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*Address*_____

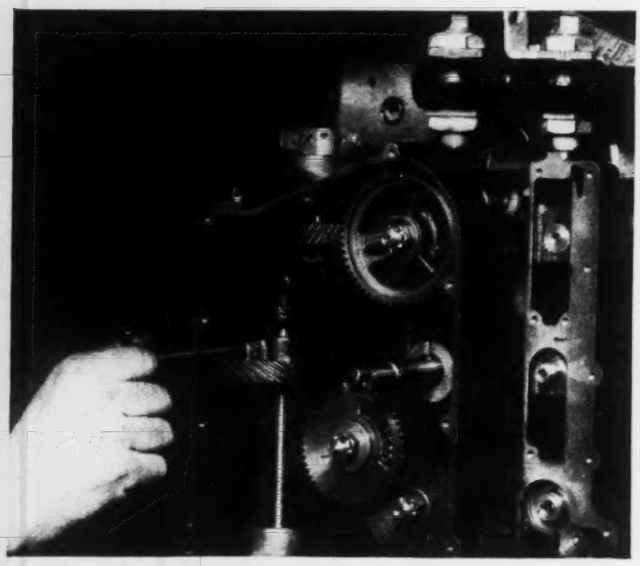
*Company*_____ *Title*_____

M. D.-11-34

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

Miners, refiners and rollers of Nickel. Sole producers of Monel Metal.

For a TIGHT Set in a *TIGHT Place*



—there's nothing like Bristo Screws

IN TIGHT and unhandy places the advantages of the Bristo socket design are immediately evident. The Bristo Wrench slides into the fluted screw socket with unusual ease. It grips tight instantly, and the screw responds without strain under the slipless hold of the wrench. Adjustments take on new ease and positiveness.

When an extra tight set is desired, you can use all of the force necessary without danger of rounding out, splitting or jamming a Bristo Cap or Set Screw. The gearlike action of the wrench in the socket guides pressure AROUND instead of against the sidewall of the socket. This principle also results in longer wear, and the unique design of the socket discourages tampering and adds to appearance.

You can equip your machines or your products with Bristo Screws at NO EXTRA COST. Let us send samples for trial with full details.

THE BRISTOL COMPANY, WATERBURY, CONN.
Branch Offices in Principal Cities; Canada: The Bristol Company of Canada, Ltd., Toronto; England: Bristol's Instrument Co., Limited, London, S.E. 14.

TRADE MARK
BRISTO
REG. U.S. PAT. OFF.

***Hollow Safety* SET SCREWS**
***Socket Head* CAP SCREWS**

bearing on the under side of the member. This adjusting screw may be turned by a kerf 9 and by locknut 10.

By the provision of the slots or kerfs 6 distributed along the insert member in staggered relation, flexibility of the section is effected, as well as sufficient extensibility to permit raising or lowering. In all adjustments it will be noted that the ends of the insert piece will maintain their relation to the adjacent portions of the main body to furnish a flush joint so that there will be no depression or shoulder at the point where the end of the insert abuts the adjacent portion of the main body of the cam. Number of the patent is 1,968,945.

Review of Noteworthy Patents

Other patents pertaining to design are described briefly as follows:

CAMERA—1,974,842—An object of this invention is to provide a camera which includes mechanism for creating a suction at the proper interval for holding the film flat over the photographic exposure area. Assigned to Fairchild Aerial Camera Corp., Woodside, N. Y.

ELECTRIC TOBACCO FEED—1,977,991—A means for electrostatically charging a traveling surface operative to cause it to forward tobacco from a source of supply by adhesion is covered by a patent recently assigned to American Machine & Foundry Co., New York.

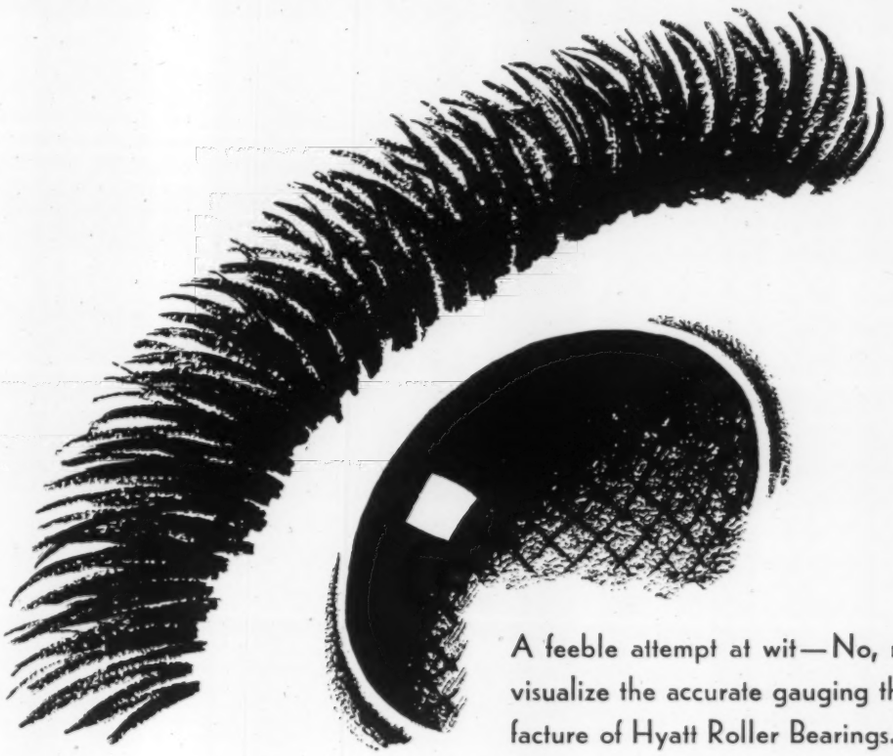
LAUNDRY MACHINE—1,969,177—Embodied in this invention is a casing for a centrifuge having an upright bearing rigidly secured in its bottom, a supporting frame and a flexible cushioning element connecting the frame and casing adjacent to the bearing. Assigned to Apex Electrical Mfg. Co.

PIE TRIMMER AND SEALER—1,977,309—This invention includes a means for causing relative rotation of a pie holder and rolling action of rollers on the pie crust to sever it. Assigned to Pie Bakeries Inc., Newark, N. J.

VIBRATION ABSORBING CONNECTOR—1,975,145—This patent covers a connector for yieldably connecting two members comprising a metal cup having means for fixing to one of the members a head adapted to be fixed to the other member. The head and a rubber body form a closed chamber in the cup. A liquid is entrapped permanently in the chamber and aids in sustaining axial compression loads upon the connector. Assigned to General Motors Corp.

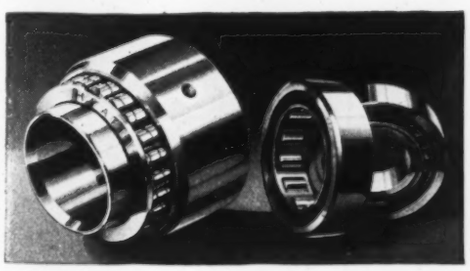
DUSTLESS ROCK DRILL—1,978,964—Embodied in rock drill design is a casing having a piston chamber and a hollow drill steel extending into the casing to operate in conjunction with a hammer piston in the piston chamber. An anvil block in the casing transmits the blows of the hammer piston to the drill steel. A water tube in the anvil block supplies cleansing water to the drill steel, and a passage in the anvil block and the casing provides communication of the bore with the atmosphere to permit the escape of pressure fluid leaking from the piston chamber into the bore. Assigned to Ingersoll-Rand Co.

By Comparison . . .
A GNAT'S EYEBROW *would resemble* A SHOE BRUSH



A feeble attempt at wit—No, merely an effort to help you to visualize the accurate gauging that goes into the precision manufacture of Hyatt Roller Bearings.

So powerful and finely calibrated are some of the optical measuring instruments at the Hyatt plant, that a high degree of accuracy to 1/200,000th of an inch is possible in the inspection of our tools and gauges. Using the same measure of perfection, a gnat's eyebrow would look like a shoe brush.



The best materials, plus the most advanced designing, would go for little without this super-positive control of accuracy—an accuracy that has distinguished Hyatt Roller Bearings for over forty years, placing them in first choice position of machine and equipment builders and users alike. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, Oakland.

HYATT
ROLLER BEARINGS
PRODUCT OF GENERAL MOTORS

SHAKEPROOF

Shakeproof's Locking Principle protects all vital connections

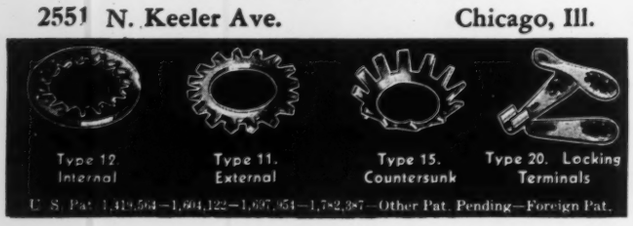
Send today for your free copy of this complete Shakeproof Catalog. Explains thoroughly the many advantages that Shakeproof offers—also shows new patented Shakeproof products.

VIBRATION—the enemy of performance—need only loosen a single screw or nut to cause the failure of an otherwise perfect product. This means that a lock washer which will keep all connections tight—even under severe vibration—is a real necessity for smooth, trouble-free performance. Shakeproof does lock connections tight—its twisted teeth bite into both work and nut surfaces and never let go. Its positive multiple-locking principle is the most certain way to protect your product from the damaging action of vibration. Write for free testing samples today.

SHAKEPROOF
Lock Washer Company

Distributors of Shakeproof Products
Manufactured by Illinois Tool Works

2551 N. Keeler Ave. Chicago, Ill.

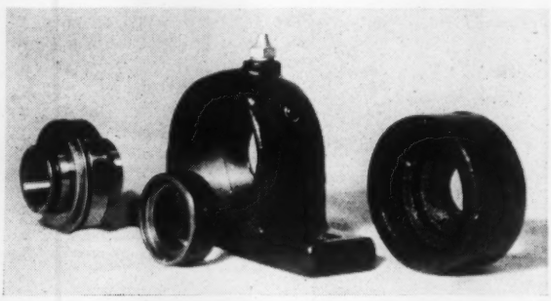


U. S. Pat. 1,415,564—1,604,122—1,607,954—1,782,387—Other Pat. Pending—Foreign Pat.

New Materials and Parts

Pillow Blocks Are Cork Insulated

CORK-INSULATED ball bearing pillow blocks of the wide inner ring type with self-locking collar have been introduced by Fafnir Bearing Co., New Britain, Conn. The bearing is of deep groove, large ball design, affording high load capacity, thrust as well as radial. The housing is of cast iron with ribbed base, designed so as to possess maximum strength



Bearing of deep groove, large ball design affords high load capacity

within the limited physical dimensions. Prelubrication at the time of assembly eliminates the need for attention for a year, while lubrication is renewable by means of grease tubes reached through fittings in the housing.

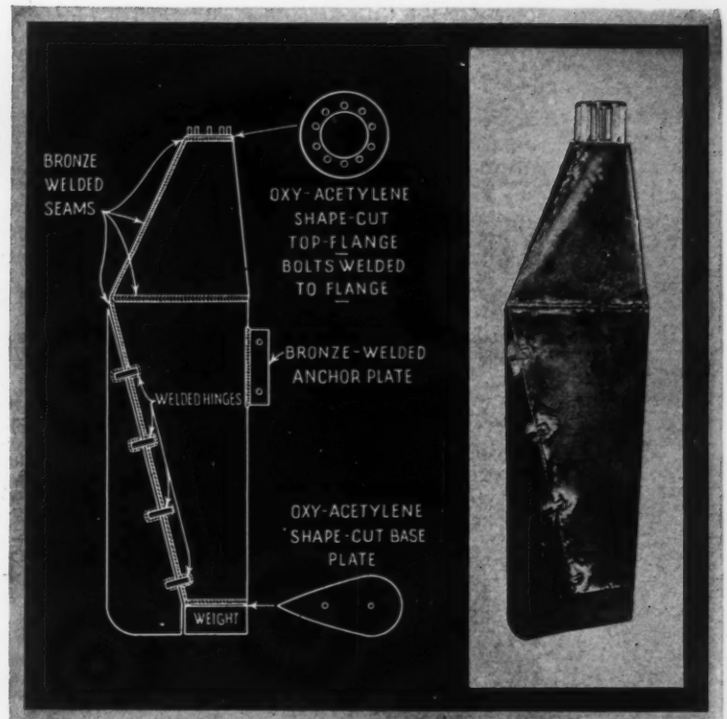
Insulation is a cork pad, shown in the accompanying illustration, which fits into the housing and around the bearing itself to insure silent operation. The pad is treated so that no separation of particles can occur. It acts also as a seal against the escape of lubricant or the entrance of dirt. Features of the pillow block include compactness, self-alignment, ease of assembly and quietness.

Unit Oil Seal Has Four Parts

EMPLOYING a packing member made of a composition material having the characteristics necessary to withstand oil seal service, the new unit oil seal introduced by Garlock Packing Co., Palmyra, N. Y. has only four parts, the adapter, the spreader, the sealing member and the case. The sealing ring is of distinctive shape, the composition material being molded under heat and pressure into a ring having a cross-sectional shape resembling a modified V. The spreader of the Klozure, as the unit, shown herewith, is known, is a flexible metal ring with serrated or saw tooth edges formed into a V shape

for Production Speed and Low Cost

Redesign for OXWELDING



Through the cooperation of Linde Process Service, the manufacturer of these river buoys was able to organize his shop for production oxwelding and to make a profit on the first lot. The suggestion of the Linde Service Operator that bronze-welding be used resulted in a strong, rustproof joint, greater speed in manufacture, and an estimated saving of over 50 per cent for gases and labor.

PRODUCTION costs of these river buoys were not low enough to meet contract prices and still produce a profit. This manufacturer, seeing the need for better metal-joining methods, called on Linde Process Service to help redesign the buoys for oxwelding.

On Linde's recommendation the job was laid out for oxwelding with bronze. Linde Service Operators helped to train and organize the welders to do the work under Procedure Control. Jigs were designed and built to insure fast, accurate production. The result—the contract was completed, the buoys delivered ahead of the specified time, and the manufacturer made a satisfactory profit. A repeat order for additional units confirmed the customer's approval of the job.

In this typical incident Linde Process Service employed only one of the hundreds of the oxy-acetylene welding and cutting application principles with which many years of experience in the development of the oxy-acetylene process have made it familiar. If you are designing or redesigning, the trained Linde representative, who will call at your request, may be able to suggest money-saving ideas which can be used in your manufacturing operations.

A letter or telephone call to the nearest Linde Sales Office will assure you the cooperation of this service. There is no obligation.

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THE LINDE AIR PRODUCTS COMPANY

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IN CANADA, DOMINION OXYGEN CO., LTD., TORONTO

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ALL STEEL
CONVEYOR CHAINS

with

Roller Chain Construction
Standard and Special Attachments
Riveted and Detachable Types

Write for
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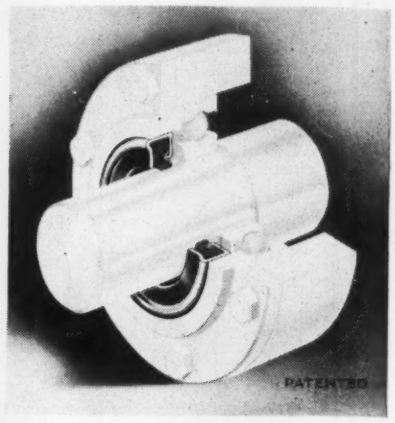
THE WHITNEY MFG. CO.
HARTFORD, CONN. U.S.A.

to fit into the convex face of the sealing ring. The angle of the V in the spreader is broader than the angle of the sealing ring; therefore, when the seal is assembled and the spreader brought into contact with the sealing ring its saw toothed edges or fingers bear upon the sealing ring causing it to hug the shaft. The function of the spreader is to supplement the inherent resilience of the packing ring itself.

The adapter, a metal ring flanged to contact the spreader, bears against the packing ring,



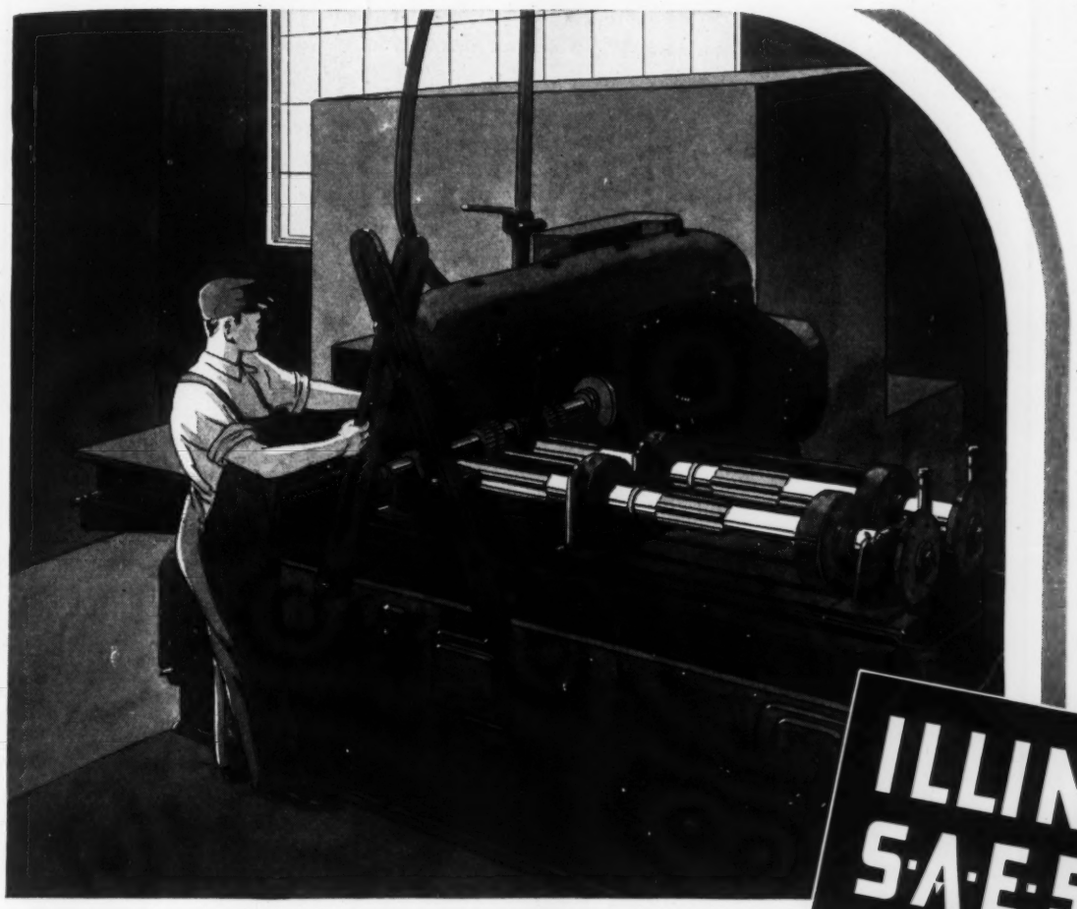
Packing member in recently introduced unit oil seal is made of composition material

holding it firmly in place in the case and preventing leakage between the outside diameter of the ring and the case, and exerts constant pressure upon the spreader. As in all self-contained or unit seals, a metal case or housing enclosed the several parts. The last operation in the assembly of this seal is to flange the edges of the case over the adapter ring. This holds the parts firmly in place, combining them into a unit. The seals are made in a wide range of standard sizes to fit shafts from ⅜ to 3 inches diameter. For most shaft sizes, standard cases in a number of different diameters and depths can be furnished.

Introduces New Motorized Reducer

A NEW motor with built-in speed reducer has been added to the line of such parts manufactured by Dumore Co., Racine, Wis. The Type K3-M 1/7 horsepower motor, shown herewith, is equipped with a single gear reduction unit which is capable of carrying the full power of the motor. It is of the universal type, operating on either direct or alternating current. The gear unit is fitted with a single ball thrust bearing to take the thrust of the worm. Reverse rotation can be accommodated by fitting the motor with a ball thrust bearing at the opposite end of the gear unit. The motor has a forced air ventilating system, making it suitable for continuous duty.

Three gear ratios can be supplied from stock —5:1, 14½:1, and 34:1, giving shaft speeds of 1300, 448 and 191 revolutions per minute re-



ILLINOIS S·A·E·5140

SMOOTH under the tool

HERE'S an exceptionally clean steel, machines easily, and produces physical properties that have led to its widespread use for axles, spline shafts, steering knuckles, spindles and other applications where relatively high tensiles are required.

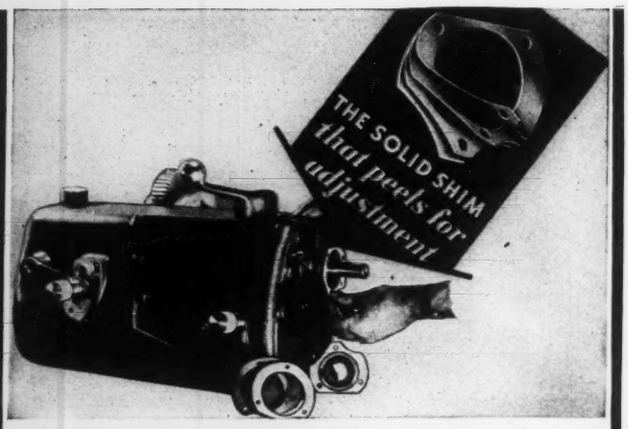
Illinois S. A. E. 5140 is easy on tools; it responds readily to heat treatment; providing the required tensiles and Brinell hardness. It can be annealed to an ideal machining range of 180 to 210 Brinell.

Additional information on this steel and its application to specific uses will be furnished upon request.

Illinois Steel Company
208 SOUTH LA SALLE STREET · · CHICAGO, ILLINOIS
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

ILLINOIS *alloy* STEELS

ALWAYS DEPENDABLE



Quick Change Gear Box—Monarch Machine Tool Company.

• providing quick adjustment for anti-friction bearings . . .

Quick *and* accurate service adjustment of anti-friction bearings is a feature of this Monarch quick change gear box . . . made possible by Laminum shims.

Adjustments of .003" . . . or any multiple of that thickness . . . may be made as often as required during the life of the equipment by simply p-e-e-l-i-n-g the laminated brass shim.

No miking. No filing. *Always* more accurate . . . always more economical to use.

LAMINUM

LAMINATED SHIM COMPANY, INC.
2126 Forty-fourth Ave., Long Island City, N. Y.

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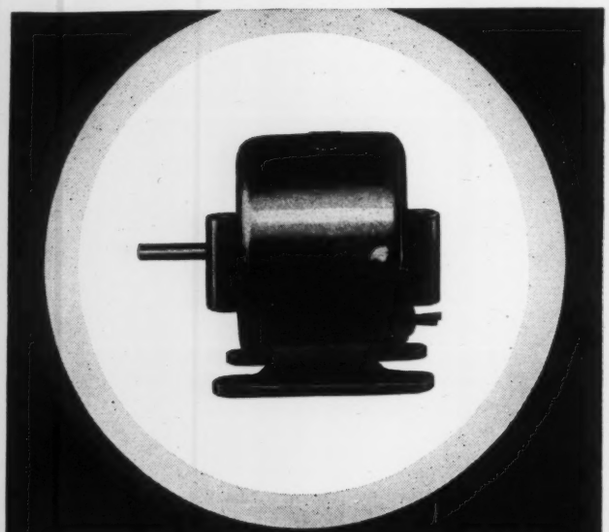


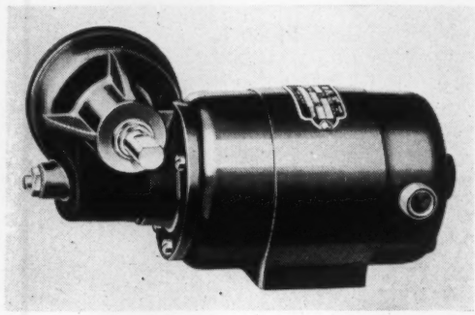
FRACTIONAL HORSEPOWER MOTORS
Universal, Shaded Coil Induction, or Split Phase . . . . plain or backgeared . . . . in sizes from 1/1000 to ¼ HP. made to meet your requirements. SIGNAL has a background of over 40 years as successful builders of small motors. . . . Prices reasonable . . . . quality the best. Write us about your motor needs.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan

OFFICES IN PRINCIPAL CITIES

SIGNAL
MANUFACTURERS OF ELECTRICAL PRODUCTS

spectively. The grease type gear housing forms an integral part of the motor frame. When required, the gear unit can be positioned on the motor case so that the gear shaft projects at any

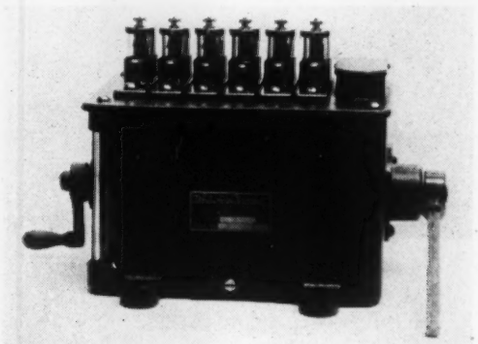


Universal motor is equipped with built-in speed reducer

desired angle in relation to the base, (always at right angles to the armature shaft). Complete with gear unit, the motor weighs 7½ pounds.

Lubricators Are Totally Enclosed

TOTALLY enclosed force feed lubricators for automatically supplying oil to bearing surfaces are a recent innovation of Hills-McCanna Co., 2349 Nelson street, Chicago. These lubricators, shown herewith, are manufactured in sight feed and blind feed models. In the sight feed lubricator a single plunger is employed to take the oil from the reservoir, measure it and force it to the delivery point. The plunger is actuated by a rocker arm traveling on an eccen-



An exact amount of oil is delivered with each stroke of lubricator

tric, the rocker arm driving the plunger in a straight line.

On the discharge stroke the oil is forced to the delivery point under pressure and, at the same time, oil is drawn from the reservoir for the next delivery. On the down stroke the oil in the suction chamber is forced through the sight feed intake nozzle into the sight feed chamber and then admitted to the discharge side of

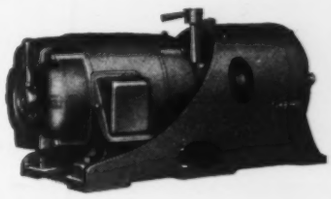
the plunger, which is separate and apart from the suction side of the pump. The exact amount of oil passed to the sight feed is delivered at each stroke. Adjustment from one to ten drops at each stroke against varying pressures up to 2000 pounds is possible.

Generally the blind feed type is the same as the sight feed type with the exception of the built-in sight feed, which has been eliminated. Glycerine or blinker sight feeds to indicate delivery are available with this type lubricator. For services where it is not desirable to have either a blinker or glycerine sight feed, an indicator can be provided that operates with the pump plunger to show the length of stroke the plunger is taking.

Gear Motor Has Eight Speeds

A FOUR-SPEED motor and a two-speed gear are employed to make up a new eight-speed gear motor being marketed by Century Electric Co., St. Louis. Two, four and six-speed gear motors, consisting of the two-speed gear equipped with a one, two or three-speed motor, are also available. The motor may be wound for either single, two or three-phase power. The gears are of the helical cut type and are provided with antifriction bearings throughout. Speed is changed by a lever placed at the top of the gear housing.

These gear motors, shown herewith, are of the all-motor type, making use of a standard, horizontal, ball bearing motor. A resilient coupling is used between the motor and gear. The unit is especially applicable where the ratio of speeds must be other than that obtained by a multi-speed induction motor. They can be supplied in open, totally enclosed or splash proof design.

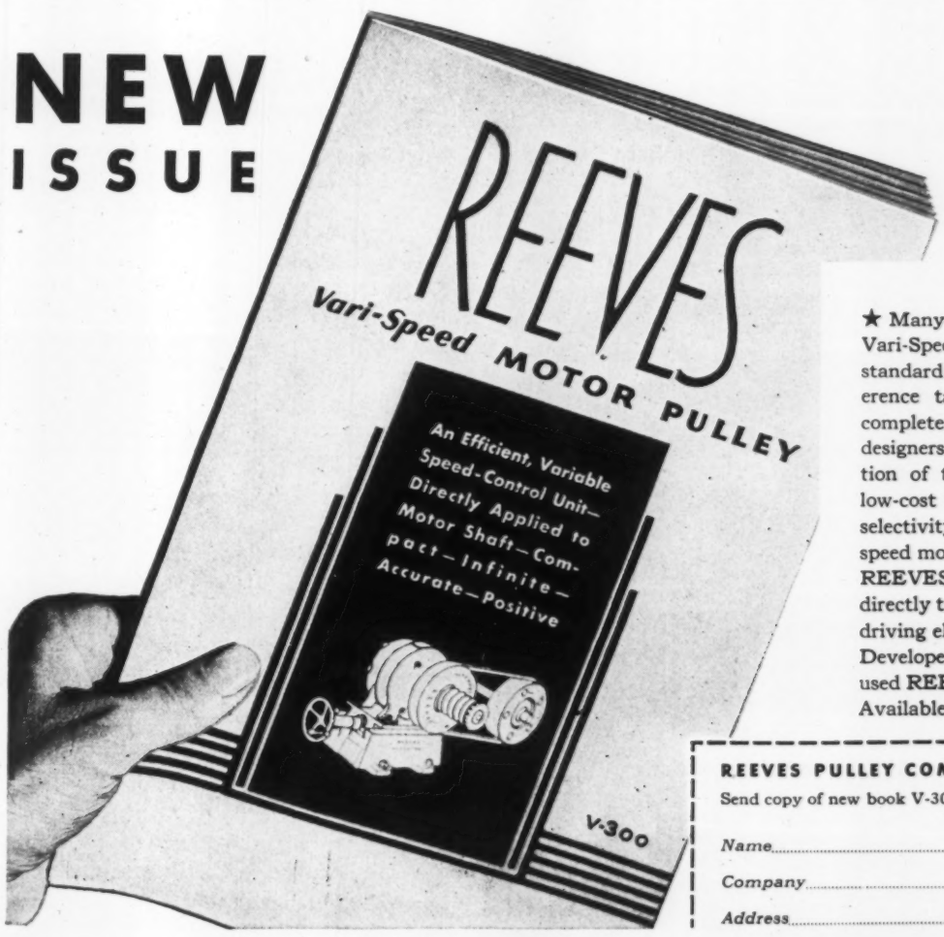


Combination of multi-speed motor and gearset provides eight speeds for driving

Washers Designed for Aviation Uses

WASHERS especially adapted to the aviation industry have been added to the line of these parts being manufactured by Wrought Washer Mfg. Co., Milwaukee. In designing these washers, full account has been taken of the aviation standards established by the U. S.

NEW ISSUE



Send for your copy of this valuable Reference Book

★ Many new examples of how the **REEVES** Vari-Speed Motor Pulley is being used as standard equipment. New time-saving reference tables, blue prints, etc., supplying complete engineering information for machine designers. Fully describes design and operation of this simplified, extremely compact, low-cost unit which provides *infinite* speed selectivity over a 3:1 ratio for any constant speed motor from fractional to 7½ H. P. The **REEVES** Vari-Speed Motor Pulley is applied directly to regular motor shaft, forming actual driving element between motor and machine. Developed by manufacturers of the widely used **REEVES** Variable Speed Transmissions. Available in seven sizes.

REEVES PULLEY COMPANY, COLUMBUS, INDIANA

Send copy of new book V-300 on REEVES Vari-Speed Motor Pulley. (H-11-34)

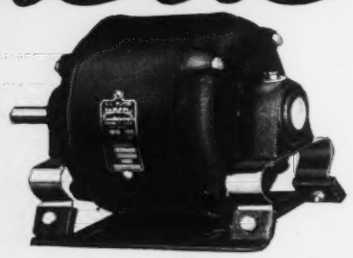
Name.....

Company.....

Address.....

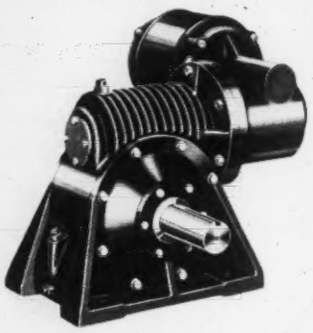
Janette

SPECIAL MOTORS



SPRING MOUNTED MOTOR

Janette motors have been noted for years for developing high performance standards. These motors are built for those discriminating manufacturers of motor-driven equipment who believe that their machines are no better or more dependable than the motors which drive them. With this high quality, Janette motors are available at prices which compare favorably with those of motors built to sell at a price basis. Put your special motor application up to Janette.



Motorized Speed Reducers

In a wide range of types and sizes, single and double reduction, 1/50 to 5 horse power. Adapted to practically any machine. Entire unit built and guaranteed by Janette. Send for Bulletin 22-1 and 22-33.

Janette Manufacturing Company

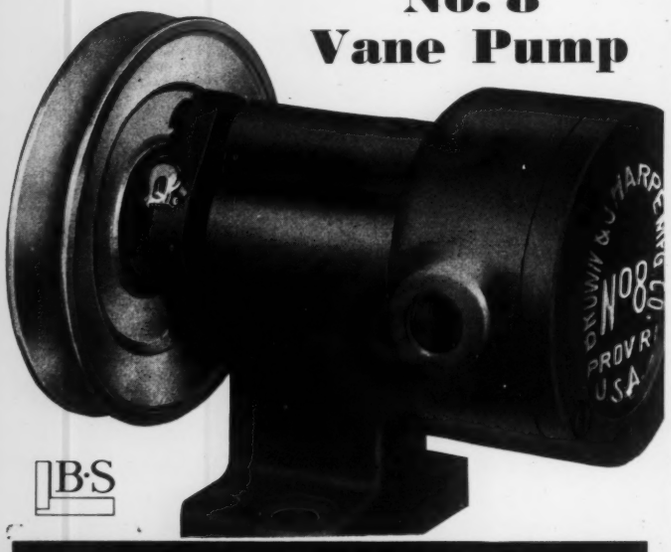
555 West Monroe St. Chicago, Illinois

Small - Compact - Steady Flow

For circulating oil or lubricating mechanical units

Pump provides steady flow regardless of rotation—discharge can be reversed, however. Small, compact—a fine dependable unit. Get our Pump Circular. Sent on request. Brown & Sharpe Mfg. Co., Providence, R. I.

No. 8 Vane Pump



B·S

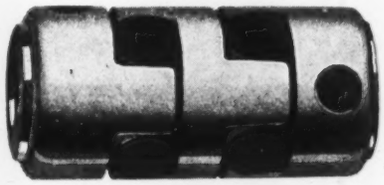
Brown & Sharpe Pumps

Geared — Vane — Centrifugal

Army and Navy. The washers can be furnished in any of the several materials officially specified by the government for this type of requirement.

Coupling Is More Flexible

QUIET operation and greater flexibility are offered by the new flexible coupling designed by Lovejoy Tool Works, 5007 West Lake street, Chicago. The coupling, shown in the accompanying illustration, is recommended for use on machines where quietness is essential, where there is vibration, and where there is difficulty



New coupling employs an aluminum center unit

in lining up the drive and driven units. It is being used by manufacturers of oil burners, office devices, coin operated musical instruments, air conditioning units and similar equipment.

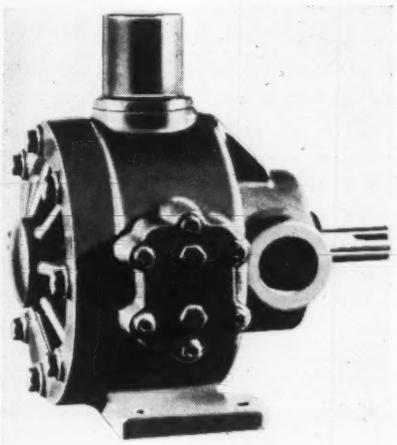
The new assembly has an aluminum center unit which has jaws facing in both directions but staggered. By using two spider cushions and a center unit, the coupling is given more length, quietness is improved and flexibility added. The coupling is made with shaft diameters up to and including one-half inch.

Simplified Hydraulic Pump Introduced

EMBODYING simplified design and sensitive control, a new variable volume hydraulic pump has been developed by Racine Tool & Machine Co., Racine, Wis. Constant pressure of 500 pounds per square inch with momentary pressures up to 1000 pounds are available in three sizes of pumps with volume ranges from zero to 2000, 4000 and 6000 cubic inches per minute. These three sizes are furnished in one size of pump case, the variations in capacity being obtained by varying the width of pump rotor. Pumps are of the multiple vane type, having 13 vanes which when revolved at a constant motor speed of 1200 RPM provide 15,600 impulses per minute.

Volume is controlled from zero to maximum by offsetting the governor ring or pumping chamber mechanically or automatically. Automatic control is provided by a piston type of hydraulic governor which reduces volume automatically a sufficient amount to maintain any desired line pressure. This feature has a dual purpose in that it eliminates all bypassing of surplus oil with a consequent reduction in tem-

perature rise of the oil, and also reduces the horespower input in direct proportion to the volume of oil pumped. These pumps, shown herewith, are extremely compact, making possible



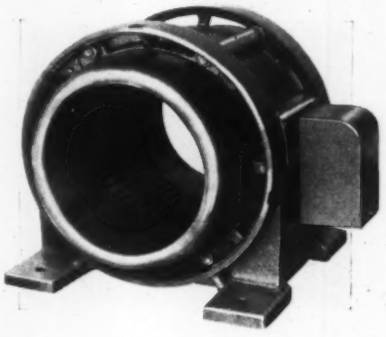
Volume in hydraulic pump is controlled by offsetting the governor ring either mechanically or automatically

installation as built-in units without the necessity of mounting independently.

The design is simple, consisting of only seven distinct parts, exclusive of the roller bearings, vanes and pump case. All of these parts are hardened and ground.

Motor Coils Are Protected

PERMANENT coil protection is afforded by the new "Seal-Clad" motors of open type construction recently introduced by Allis-Chalmers Mfg. Co., Milwaukee. Hard, smooth bakelite shields are sealed over the stator coils giving protection against metallic dust, grit, oil, moist-



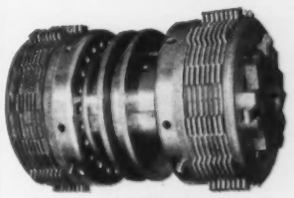
Bakelite shields are sealed over the stator coils giving permanent protection to new motor

ure, mild acids and other agents injurious to insulation. The motors, shown herewith, are built in ratings up to 25 horsepower, 1800 revolutions per minute, and suited to a broad range of application. Features include frames of cast-steel; twistless and distortionless stators; silver-brazed rotors; oil and dust-tight sleeve or anti-friction bearings.

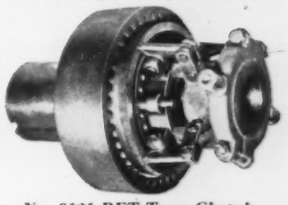
CLUTCH SPECIALISTS SINCE 1917

In 1917 Twin Disc began by being different — building a better clutch for tractors. Twin Disc Clutches have been known for their better design ever since. Today they are famous in every industry for their *unfailing reliability*. The prevailing trend toward product redesign finds the Twin Disc Clutch Company completely organized to meet effectually the greater needs of the designer, manufacturer, and user of industrial machinery. New clutch types of greater adaptability and wider uses have been added to the more than 400 types and sizes of Twin Disc Clutches and Power Take-Off Units already developed by seventeen years of clutch specialization. *Write* for engineering data . . . specific recommendations on request. No obligation.

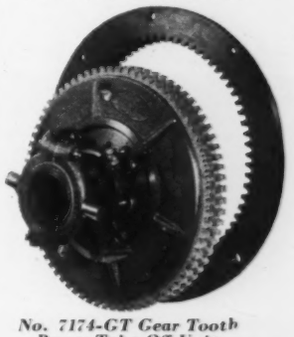
Twin Disc Clutch Company, 1325 Racine St., Racine, Wis.



Close Coupled Duplex Clutch



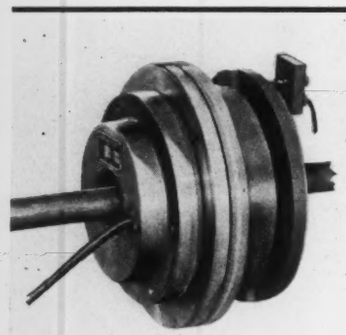
No. 8121 BFT Type Clutch



No. 7174-GT Gear Tooth Power Take-Off Unit

TWIN DISC CLUTCHES

NEW STEARNS COMBINATION MAGNETIC CLUTCH AND BRAKE



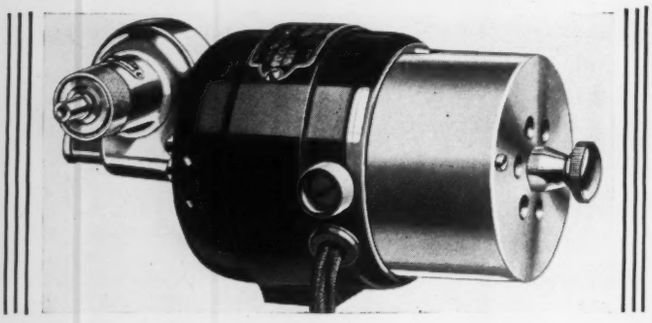
PROVIDES both clutch and brake action for motor driven spindles on machine tools. Belt shifting and manual stopping are wholly eliminated; accurate control of the machine is easily maintained when equipped with this unit. Smooth, positive clutch or brake action is provided by magnetic operation.

Details: Magnetic clutch is 10 inches in diameter; torque rating of 1000 inch lbs. Magnetic brake is 8 inches in diameter; torque rating of 350 lb. inches. Armature is slideably keyed to the shaft and used for both clutching and braking. Collector rings are mounted within sheave to conserve space; a unique feature.

Compact, simple, and sturdy. Write for complete information.

MAGNETIC MFG. COMPANY
651 TL—S. 28th St., Milwaukee, Wis.

HIGH STEARNS DUTY



Dumore Now Offers Controlled Power

Equipped with electric governors, Dumore motors can now be had for those applications requiring constant speed and power. . . . Governors are available in two types—adjustable and fixed—on 1/64 to 1/8 H. P. Dumore series universal motors, with or without gear reduction units. . . . Write for additional information.

THE DUMORE COMPANY, 100 Sixteenth St., Racine, Wis.

DUMORE MOTORS

Chromium Irons Combat Heat, Corrosion

(*Concluded from Page* 36)

carbon content. The value of the use of nitrogen bearing ferrochrome is apparent by comparing the physical properties of irons 1 and 2. It seems logical to expect improvement in the physical properties of all types of high chromium cast irons when nitrogen bearing ferrochrome is used.

High chromium irons containing less than about 30 per cent chromium may be softened by annealing and may be hardened by quenching in oil or air from 1900 degrees Fahr. or higher. Irons containing over 30 per cent chromium are practically unaffected by heat treatment. Irons that are responsive to heat treatment may be hardened to a brinell hardness in excess of 600. This type of iron may be used for abrasion resistant service.

Fatigue Failures Discussed

In discussing fatigue tests of high strength cast iron at the meeting, H. F. Moore and J. J. Picco noted that under torsional stress a brittle material like cast iron fails not in shear, but under diagonal tension stress. The maximum diagonal tension stress (pounds per square inch) is equal to the maximum shearing stress under torsion. It would seem, then, since in both flexure and torsion tests the failure is a tension failure, that the endurance limit should be about the same. In general, the results of the tests reported in this paper indicate that the fatigue strength of the irons tested is approximately proportional to the static tensile strength of the irons.

W. H. Hatfield, director, Brown-Firth Research Laboratories, Sheffield, England, brought out in his discussion of "Steel Castings" that it must never be forgotten that a steel casting is not a steel forging. The latter is based on an ingot, the production of the soundness of which has been the first consideration; simple in design, narrowest section at the bottom, greatest sectional area at the top and the ingot proper having superposed upon it an adequate refractory lined feeder head.

On the other hand, as regards castings, the designer produces the ultimate shapes most likely to serve his purpose best and looks to the foundry to make the best job it can of the case. The result generally is good. It should, however, be borne in mind that a higher factor of safety is advisedly applied in the case of castings than in the case of forgings. The occasional unsoundness or the hidden defect must not unduly prejudice the working parts.

Protecting Sales Value of Appearance

(*Concluded from Page* 18)

has no ill effect upon the protection afforded by the mechanical patent.

Attempts have been made to obtain patents upon articles that are used in some obscure or hidden place. But, design patents are usually granted for their appearance. The doctrine has grown up that if an article is used in a hidden place the question of appearance is of no consequence. Upon this question there have been conflicting decisions. The argument against the "doctrine of obscurity" is that the article is visible when displayed upon the counter or at the store, and the mere fact that it is invisible when in use has no bearing upon the question of patentability. Thus, it was held that a novel design for a knitted tie, as an example, which was pleasing and attractive when displayed on the counter is patentable, notwithstanding the fact that the novel or attractive feature of the tie was hidden when the waistcoat was worn. This holding was based upon the fact that the utility of the design resided in its appeal to the purchaser.

Location May Bar Patent

A drilling hammer, used many thousand feet below the ground when drilling wells, was held to be unpatentable as a design on the ground of the "doctrine of obscurity." In this case the Court did not place much significance upon the fact that the article, when displayed to the buyer, had a rather unique design. The Court seemed to think that the hidden use to which the article was put was more important than its appearance to a purchaser.

In the event of infringement of design patents, it is difficult to ascertain the actual damages resulting from the unauthorized use of the design as there is no way to determine just what influence the appearance of the article had on the number of sales made by the defendant. To obviate this difficulty, Congress passed a law which holds an infringer liable to the amount of $250 from the sale of the unauthorized article or articles. In the event the total profit made by the defendant exceeds $250, the defendent is held liable for the additional amount.

When a design patent is granted it is important that the patent number be in some fashion, displayed upon or associated with the article. If the inventor fails to mark his device, he will be unable to recover damages in a suit for infringement except upon proof that the defendant was duly notified of the infringement and continued after such notice to make use or sale of the article so patented.

MARSH

GAUGES

Shows the complete Marsh Line—a Gauge for every application

A New Standard
IN ACCURACY!

THE sole purpose of any Gauge is to give faithfully accurate readings. A faulty Gauge is worthless and, what's more, *a real liability.* That's why leading manufacturers are turning to Marsh for their Gauge equipment. Time has proven that the exceptional precision methods and better materials used in the manufacture of the Marsh Line not only assures unfailing accuracy but also provides lasting efficiency. If your product requires Gauges of any type or size—mail the coupon below for our new catalog showing—the finest Gauges built!

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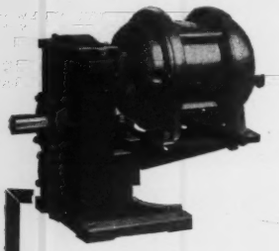
LESS SPACE

REQUIRED FOR THE CULLMAN SPEED REDUCER



● The first reduction in the Cullman Speed Reducer is a chain and sprocket drive, which reduces the first gear contact speed from 2 to 6 times the motor speed.

This permits a flat compact design—a design especially adapted for the many locations where space is limited. Motor and reducer are mounted as one unit . . . easy installation . . . less space required.

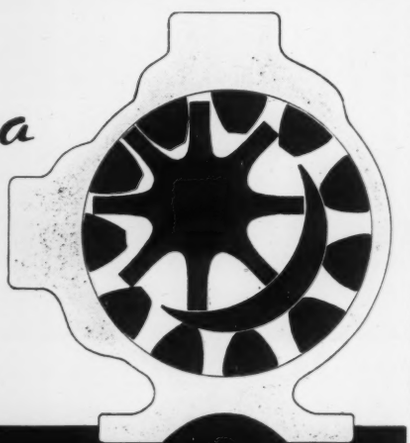
The chain and sprocket connection between motor and reducer is also more flexible and operates with less noise than a gear connection . . . and provides perfect lubrication.

CULLMAN WHEEL CO.
1356 Altgeld St., Chicago, Ill.

CULLMAN SPEED REDUCERS

Gear within a Gear

— Just two moving parts



that's the simple principle of
VIKING ROTARY PUMPS

Quite naturally the fewer the parts the less power required . . . less friction and wear . . . with a consequent longer life.

The Viking Patented "Gear Within A Gear" Principle means freedom from costly repair and service expense . . . . LOWER PUMPING COSTS.

The VIKING ROTARY PUMP backed by nearly a quarter century experience . . . and a world-wide reputation of the nearly half million Vikings now in use are sufficient reasons why your next pumps should be VIKINGS. May we send you the complete Viking Story? Write today for FREE Folder and Prices.

Viking Pump Company
CEDAR FALLS, IOWA

CABLES—General Electric Co., Schenectady, N. Y., is distributing a 128-page bulletin on its line of industrial cables which describes and lists all standard types of insulated wire and cable used by industrials for transmission, distribution and control, and used on or with electrical equipment such as mining machinery, locomotives, arc welders, etc.

CAST PARTS—The vacuum die casting method of producing aluminum bronze die castings with a strength stronger than steel is presented in bulletin No. 5 of Aurora Metal Co. Inc., Aurora, Ill. The bulletin also shows parts made by this process and gives the factors which the parts must combat.

CAST PARTS—The effect of heat treatment upon structure of a cast alloy steel and the effect of carbon upon microstructure of annealed cast steel are discussed in *Ladle Sparks*, Vol. 1, No. 4, published by Sivyer Steel Casting Co., Milwaukee. Representative physical properties of annealed and specially heat treated steels and typical chemical composition of standard carbon and alloy steels manufactured by the company are included.

CONTROLS (ELECTRICAL)—Indoor disconnecting switches with silver line-pressure contacts, high voltage magnetic switches and indoor alternating current cubicle switchgear with manually or electrically operated breakers are described in recent catalog inserts of General Electric Co., Schenectady, N. Y.

DRIVES — Three-sixteenths inch pitch silent chain drives are illustrated and described in folder 1460 of Link-Belt Co., Chicago. The folder gives applications, and horsepower and pitch diameter tables.

LUBRICATION AND LUBRICATING EQUIPMENT—Hills-McCanna Co., Chicago, is distributing a bulletin on its new line of enclosed type force feed lubricators built with both positive drip sight feed and built-in feed for automatically supplying oil to bearing surfaces.

LUBRICATION AND LUBRICATING EQUIPMENT—The benefit of adding colloidal graphite to oils is presented in technical bulletin 220.1 of Acheson Colloids Corp., Port Huron, Mich., which gives a complete presentation of graphoid surfaces and the parts they play in lubrication.

MOTORS—Applications of Barcol motors to special electrical instruments are presented in application bulletin No. 5 of Barber-Colman Co., Rockford, Ill. The bulletin pictures the applications and gives the relation of the motors to the operation of the machines.

MOTORS—Application of motors to various types of drives, the development of "tailor-made" motors, reasons why the small motor manufacturer can render a specialized service on such drive problems, and a con-

densed summary of the motors in the line of the company are contained in bulletin No. 1020 of Imperial Electric Co., Akron, O.

PACKING GLANDS AND PACKING—A new unit oil seal designed to retain oil and grease within a bearing and to exclude dust and dirt, known as the Klozure, is announced in a recent bulletin of Garlock Packing Co., Palmyra, N. Y. The seal consists of four parts, the adapter, the spreader, the sealing member and the case.

PACKING GLANDS AND PACKING—National Motor Bearing Co. Inc., Oakland, Calif., has issued catalog No. 25 on its line of oil and fluid seals for confinement of oil, grease and fluids. The booklet describes the unit seals, gives applications and includes drawings of various shaft arrangements.

SHAPES—Union Drawn Steel Co., Massillon, O., has prepared a folder which includes data on parts which may be made from $\frac{5}{8}$-inch round Bessemer screw stock. The physical properties required are different for each application and all of them can be met by special cold working processes.

TESTING EQUIPMENT—Sound Engineering Corp., Chicago, has prepared a 12-page bulletin on insulating testing equipment which illustrates and describes such instruments as dielectric strength test sets, insulation resistance meters and humidity and temperature control apparatus. The bulletin discusses insulation, dielectric strength, resistivity and dielectric constant and power factor.

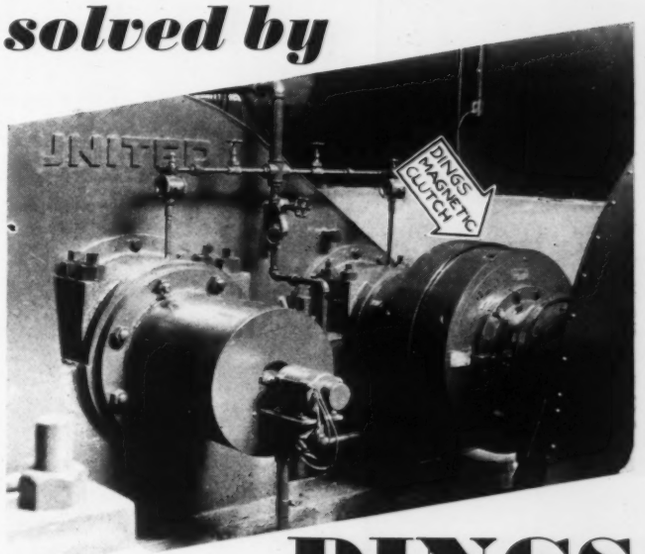
TUBING—Steel & Tubes Inc., Cleveland, has prepared a folder on its line of mechanical tubing, illustrating the types available, applications and sizes.

WELDED PARTS AND EQUIPMENT—Lincoln Electric Co., Cleveland, has prepared a bulletin, No. 304, giving general specifications for its line of engine-driven type SA300 welders.

Research Publications

Service Characteristics of the Light Metals and Their Alloys. This report was prepared to present in convenient, concise form essential technical data and information for aluminum, magnesium and the more important alloys of these metals. The publication is arranged in four parts: Metallurgical characteristics; industrial requirements; surface protection; and tabular data. Under the first section there is a discussion of chemical composition, heat treatment, welding, etc. The section on industrial requirements evaluates the usefulness of light alloys in certain fields including aircraft, automotive, general structural and architectural work, railway equipment and household appliances. While for most applications no surface protection is used, there are times when this is desirable. The discussion in the report covers painting, anodizing or the artificial production of an oxide coating, and electroplating. The latter two items apply specifically to aluminum. The section on tabular data includes 16 tables covering trade designations; nominal compositions; physical constants; typical mechanical properties; and foundry characteristics of casting alloys. Published by American Society for Testing Materials, 260 South Broad street, Philadelphia. 30 pp. 50c.

ONE
of many problems solved by



DINGS
Magnetic Clutches

HERE was a problem of synchronizing the drive units on the screw downs of finishing mills for making strip steel. Dings Magnetic Clutches made this synchronization perfect, positively tying the worm shafts together and eliminating creeping.

And what of the machinery you are building—is there a clutch problem—a problem of remote control, simplification, saving space, economy? If there is, you should investigate Dings Magnetic Clutches.

Magnetic clutches assure instant engagement, they are particularly simple and economical where remote control is required, they slip with overload, they can be used with high speed drives, and their small size and great power solve many a clutch problem where reduced space must be considered.

EXPERIENCE that saves money

No other manufacturer can offer you the years of experience in the building of magnetic equipment that is Dings'. Since 1899 Dings engineers have been solving separation, magnetic protection and power transmission problems, supplying the major needs where magnetic equipment is required.

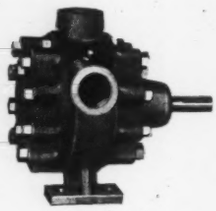
This experience is your assurance of dependable advice, helpful cooperation and a proved product. There is no cost in taking advantage of it.

Let our engineers cooperate with you. They bring you the experience of the oldest manufacturers of magnetic equipment.

DINGS MAGNETIC SEPARATOR CO.
666 Smith Street, Milwaukee, Wisc.

Dings High Intensity MAGNETIC CLUTCHES

THE HEART OF POWER



909 Series

Used on machine tools for rapid traverse, tool feeds, press work . . . for sidewalk elevators, portable truck lifts, etc.

The No. 909 Series, shown here, is one of several Roper Pressure Pumps for hydraulic power transmission. Roper rotary gear type pumps are made in many sizes and capacities.

Write for Bulletin No. R-5-MD.

ROPER PUMPS

Dependable *Since 1857*

GEO. D. ROPER CORP., ROCKFORD, ILL.

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By Virgil M. Faires $4.00

Plastic Molding
By Louis F. Rahm $3.00

Machine Design
By Louis J. Bradford and Paul B. Eaton $3.00

Inventions, Patents and Trade-Marks
By Milton Wright $2.50

Book of Stainless Steels
Edited by Ernest E. Thum $5.00

Procedure Handbook of Arc Welding Design and Practice
Published by Lincoln Electric Co. $1.50

Add 15c for postage

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MACHINE DESIGN
Penton Building, Cleveland, Ohio

336-M.D.

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MACHINE DESIGN is a monthly technical publication conceived, edited and directed expressly for those executives and engineers responsible for the creation and improvement of machines built for sale, and for the selection of the materials and parts to be used.

Business Announcements and Sales Briefs

FRANK J. CONNOLLY has been appointed sales engineer for the New York office of Allen-Bradley Co., Milwaukee. The New York office is located at 50 Church street. C. N. Calkins is district manager.

* * *

J. J. Byrne has been appointed sales representative at Cleveland for Empire Sheet & Tin Plate Corp., Mansfield, O., succeeding Glenn D. East, who has resigned to become associated with Wheeling Steel Corp., Wheeling, W. Va.

* * *

Revere Copper & Brass Inc., New York, has opened an office at 804 Tower Petroleum building, 1905 Elm street, Dallas, Texas. W. Russell Weil is southwestern district manager.

* * *

Electro Dynamic Works, Bayonne, N. J., division of Electric Boat Co., manufacturer of electric motors and generators, has appointed N. M. Mintz as representative with offices at Fortieth street and Calumet avenue, Chicago.

* * *

Garrett Burgess Inc., 5050 Joy road, Detroit, has been appointed representative for Magnetic Mfg. Co., Milwaukee, in the Detroit territory. The Burgess company will handle the entire line of Magnetic equipment which includes magnetic brakes, magnetic clutches, solenoids, magnetic conveyor rolls, and other similar devices.

* * *

Norma-Hoffmann Bearings Corp., Stamford, Conn., manufacturer of ball and roller bearings, has appointed E. W. Lawrence as Southern representative with headquarters at 1841 Plaza, Charlotte, N. C. For the past eleven years Mr. Lawrence has been with the New York sales office of the company.

* * *

E. S. Rooney, who has been district sales manager for Youngstown Sheet & Tube Co. at Cincinnati for the past 11 years and has been with the Sheet & Tube company for 28 years, has been retired. Mr. Rooney has been succeeded by Kenneth J. Burns, of the home office at Youngstown, O., as sales manager for the Cincinnati district. Mr. Burns formerly was in the Cleveland sales office of the company.

* * *

F. S. Kingston and B. L. Conley have organized the Kingston-Conley Electric Co. to manufacture fractional horsepower heavy-duty motors. The factory, where the newly designed motors are now in production, is located at 66 York street, Jersey City, N. J. Mr. Kingston has been connected with Crocker-Wheeler Electric Mfg. Co., Hoover Co., and Sunlight Electrical Mfg. Co., while Mr. Conley has held positions with Hoover Co., Emerson Mfg. Co., Holtzer-Cabot Electric Co., and Sunlight Electrical Mfg. Co.

* * *

Willliam Anderson, 3701 Dartmouth avenue, Dallas, Tex., has been appointed southwestern representative for Central Iron & Steel Co., Harrisburg, Pa.

* * *

R. R. Lally, for several years manager of sales at New York for Globe Steel Tubes Co., Milwaukee, has been made vice president in charge of eastern sales for this company.

* * *

Jewell Alloy & Malleable Co., Inc. has been chosen as the new name of Jewell Steel & Malleable Co., Buffalo, N. Y., manufacturer of Jewell alloy castings, produced from heat resisting material.

* * *

Timken Roller Bearing Co. has been awarded first place for the most effectively conceived and executed industrial advertising campaign of the year in the tool and equipment division of National Industrial Advertisers association.

* * *

W. S. Todd, salesman in the Cleveland office of Carnegie Steel Co., has been transferred to Toledo, O., as resident salesman. A. G. Thorne, salesman at Toledo for the Carnegie company, has been transferred to Pittsburgh. Foster W. Lamb, salesman in the Pittsburgh district for the company, has been moved to the Cleveland office.

* * *

Belden Mfg. Co., Chicago, has completed negotiations with Frank W. Hudson of Los Angeles, Calif., which have enabled the Belden company to acquire all rights to manufacture, assemble and sell rubber connectors made under the so-called "Hudson Rubber Plug Patents," U. S. No. 1,724,592. These negotiations also included arrangements whereby the Belden company may issue licenses to others.

* * *

V. L. Conley, assistant district manager of the Cleveland sales district for American Rolling Mill Co., Middletown, O., has been transferred to the Pittsburgh district to function as assistant district manager in charge of the Buffalo office which is being opened at 17 Court Street building, Buffalo. Assisting Mr. Conley will be A. W. Bryant with headquarters at Rochester, N. Y. The territory assigned to this new office will include all of the territory in New York state from Utica west and Erie county in Pennsylvania.